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Relationship Between Teton Science School Programs and Teachers' Ability to Teach About the Environment

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RELATIONSHIP BETWEEN TETON SCIENCE SCHOOL PROGRAMS AND TEACHERS' ABILITY TO TEACH ABOUT THE ENVIRONMENT

by

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ABSTRACT

Relationship Between Teton Science School Programs and Teachers' Ability to Teach About the Environment

by

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This thesis presents an analysis of 1996/97 survey research data regarding the relationship between three types of Teton Science School (TSS) programs and classroom teachers' ability to teach about the environment. Based on observations by resident instructors and faculty at TSS, three research questions were developed. The primary objective of the research questions was to consider the relationship between TSS residential education programs and participating teachers' ability to teach about the environment.

Analyses are based on comparing descriptive statistics of teachers who have participated in one of the three types of TSS programs or a combination of the three types of programs. Where appropriate, first-order distributional comparisons are considered.

Findings of the thesis include: 1) in general, teachers who participate in TSS programs reported doing a great deal of teaching about the environment and have a positive attitude toward environmental education (EE); 2) both TSS residential education programs and outreach programs, although specifically designed for students, help teachers to incorporate EE into their teaching; 3) specific components of TSS teacher workshops, TSS residential education programs, and TSS outreach programs, which include spending time outdoors and observing others teach, were rated very highly by participating teachers for teachers' ability to incorporate EE into their teaching.

This thesis supports the idea that teacher training in environmental education can include programs that are designed for students, specifically participation in residential education programs. This thesis contributes to the future design of programs at TSS and similar centers and to the literature on long-term evaluation studies in EE, specifically teacher training in EE.

(137 pages)

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Jennifer A. Levy

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CHAPTER 1

INTRODUCTION

The need for the current research became evident after spending one year (August 1994-August 1995) as a resident instructor at Teton Science School (TSS) located in Kelly, Wyoming. This position included planning, hosting, and teaching residential environmental education programs for students of all ages, outreach programs for elementary and middle school age children, and teacher workshops.

Many school children and their teachers participated in TSS programs throughout the 1994-1995 academic year, and a difference was observed in the teachers' interest in, attitude toward, and enthusiasm for environmental education (EE). This difference was also apparent in the enthusiasm and performance of the students.

It was observed that some teachers who had participated in a residential program with their students in the past had spent time teaching EE to their students. There was a notable difference in the performance of these students in the field compared with students who had little or no previous EE. Many of these teachers recognized their role as environmental educators and acknowledged TSS residential programs as a major source of learning how to teach EE. A handful of teachers incorporated the TSS lessons into their classroom curricula in both science and nonscience disciplines.

After speaking to faculty at TSS and other nonprofit science centers in the Rocky Mountain Region, it was discovered that the topic of how to educate classroom teachers in EE is an issue that is becoming extremely important in the development of EE

programs. Currently, there is little research on the relative effectiveness of EE programs on classroom teachers. The current study looked at three different programs offered at the Teton Science School in an attempt at identifying a relationship between the TSS programs and teachers' ability to teach about the environment. The first chapter presents the justification and need for this research, including a background of environmental education and the Teton Science School. This chapter also provides a description of the three TSS programs studied and the research objectives.

Justification and Need for Study

For the purpose of this study, the Peace Corps definition of environmental education was used:

> Environmental education is a process aimed at improving the quality of life by empowering people with the tools they need to solve and prevent environmental problems. Environmental education can help people gain the knowledge, skills, motivation, values, and commitment they'll need to manage the earth's resources sustainably and to take responsibility for maintaining environmental quality. (Braus & Wood, 1993, p. 2)

It is important to understand that environmental education is different from outdoor recreation or environmental advocacy. There are many organizations that offer outdoor recreation experiences without providing information about the environment or increasing awareness about environmental issues. Some outdoor recreationists, but not all, have been accused of seeing "...rivers and mountains as settings for workouts or feats of derring-do" (Manning, 1996, p. 7). Also, environmental education provides information, not propaganda. Instead of advocating a stand on an issue, environmental

education is about providing the knowledge and information needed for a student to make up his or her own mind about environmental issues. The Teton Science School teaching philosophy states: "As educators, we teach processes that allow students to accommodate opinions other than their own by creating inclusive solutions to difficult resource management questions" (Teton Science School, 1998, p. 4).

Learning about the environment is not new, but the term environmental education has only been around since the late 1960s. The current field of environmental education was influenced by three overlapping educational movements: nature study, conservation education, and outdoor education (Smith, 1994). A major goal of today's environmental education efforts is to create an ecologically literate citizenry that possesses the awareness, attitudes, knowledge, skills, and motivation to address environmental problems and issues (Braus & Wood, 1993). This goal must be met, in part, by making environmental education a part of formal education programs. More importantly, classroom teachers must play a central role in today's environmental education programs (Ham & Sewing, 1987; Lane, Wilke, Champeau, & Sivek, 1995; Ritz, 1977; Stone, 1989).

The environmental education movement traces its roots to the writings of Henry David Thoreau, John Burroughs, John Muir, Aldo Leopold, and Ernest Thompson Seton. Each inspired an interest in the natural world while human impacts were expanding rapidly (Smith, 1994). Although nature study has been taught in schools since the early 1890s, the focus had been on the knowledge of nature and the study of the atmosphere, earth, plants, and animals. It was not until the Dust Bowl of the 1930s that

nature study evolved into conservation education, which at the time was primarily the responsibility of government agencies such as the Soil Conservation Service and the U.S.D.A. Forest Service (Manning, 1996).

In the 1960s the emphasis changed again to outdoor education. A select group of teachers realized the extent to which students were losing their connection to the natural world and took their classrooms outside (Smith, 1994). For example, Ted Major, a high school biology teacher in Jackson Hole, Wyoming, took his students "in the field" to study biology, and he later founded the Teton Science School in 1967 to continue his work with students in the out-of-doors (N. Shea, personal communication, October 28, 1997).

The environmental movement of the 1970s, motivated by many events including Rachel Carson's 1962 book, Silent Spring, caused people to look at the impacts humans were having on the environment. At the same time, studies of environmental problems were appearing in universities, high schools, and elementary schools (Smith, 1994).

The most recent trend in environmental education is towards local studies of the environment. Instead of focusing on rain-forest destruction or the plight of the panda bear, lessons are being designed to teach kids about the birds in their own backyards or where their food and water comes from. This new trend is called "sense-of-place" (based in the students' schoolyard or community) education and allows educators to focus on their own community whether it is urban or rural (Manning, 1996).

Today's EE also goes beyond identifying and studying the natural world and includes increasing awareness about issues and the conflicting values among individuals

(Braus & Wood, 1993). EE encourages students to take action and work toward solutions of current environmental problems and prevent new ones. Examples of EE at work include highway programs designed to clean up litter along the road, tree-planting programs, and helping students learn how to grow crops without the use of pesticides.

One of the major findings by Congress listed in the National Environmental Education Act (1990), Pub. L. No. 101-619, was that "current Federal efforts to inform and educate the public concerning the natural and built environment and environmental problems are not adequate" (Section 2). The Act recognizes the need for partnerships between long-standing environmental education efforts among federal agencies, local educational institutions, state agencies, nonprofit organizations, and the private sector. A few of the Act's provisions include: establishing an Environmental Education Division (EED) within the EPA, awarding EE grants, initiating a national EE recognition program, and establishing a National Environmental Education and Training Foundation.

EE has evolved outside of primary and secondary education settings as well. There are numerous university-sponsored and nonprofit science centers, nature camps, and outdoor classrooms across the country. As noted above, the mission of many of these centers is *education* as opposed to recreation or advocacy (Manning, 1996). These centers offer many different kinds of programs, for various lengths of time, and in varied settings. Although these centers offer well-developed and successful programs, their range is limited to a small percentage of this country's schoolchildren.

Ultimately, classroom teachers have the greatest potential to reach the majority of youth (Ham & Sewing, 1987; Simmons, 1993). Although other educators, whether

they are parents, counselors, youth group leaders, etc., can share in this responsibility, classroom teachers have the opportunity to teach the majority of the country's young people in formal school settings. Unfortunately, many teachers have little EE training or experience, do not consider EE their responsibility, or suffer from a lack of time and funds to teach EE (Buethe & Smallwood, 1987; Ham & Sewing, 1987; Lane, Wilke, Champeau, & Sivek, 1994; Simmons, 1993).

Consequently, for EE to be successful, classroom teachers must receive training. Teacher training in EE started in the 1970s and was mostly offered through state resource agencies in the hopes of providing curriculum like *Project Wild* for teachers to take back to their classrooms (Manning, 1996). Many of the above-mentioned schools and science centers have branched out and are offering training for classroom teachers with the hope that teachers will strengthen EE in public schools or start their own schools.

International conferences on environmental education took place in the 1970s and have helped in defining the field of EE and in identifying the needs and priorities of this new field. According to the United Nations Educational, Scientific, and Cultural Organization (UNESCO), the most urgent EE priority identified by nations attending the International Belgrade Workshop of 1975 was teacher training in EE. Also, participants at the Tbilisi Conference of 1977 concluded that both preservice and inservice training in EE should be mandatory and locally relevant (UNESCO, 1980).

Teton Science School

The current research studied teachers' experience with programs offered at Teton Science School in Kelly, Wyoming. Teton Science School is an independent, nonprofit center which offers a wide variety of field natural science programs for people of all ages. The school is located in Grand Teton National Park at the former site of a dude ranch. TSS operates on 40 acres of National Park Service land under a special use permit. The school also has restricted use of other parts of Grand Teton National Park and Yellowstone National Park as well as an outfitter's permit for use in neighboring Bridger Teton National Forest. TSS is most known for its natural science field courses for school children in elementary through high school, but it also offers adult programs including *Elderhostel* programs, teacher workshops, and adult seminars. TSS also has an outreach department that visits schools throughout the region and has recently taken on the role of training future EE leaders in its one-year Professional Residency in EE (PREE) program for graduate students.

The purpose of this research was to study the relationship between TSS programs and teachers' ability to teach about the environment. The following description, provided by TSS director of education Nancy Shea, outlines the three education programs that were evaluated for the effectiveness of teachers' adoption of EE in their curricula:

> *Residential EE Programs.* Residential EE programs are designed for public and private school groups, grades 5 through high school, and typically last from three to six days at a time. Students and their teachers stay on campus during these programs. Although teachers attend in the capacity of chaperones, many choose

to take a more active role. These natural science field courses are designed to allow students to observe and study the processes of nature at various times of the year.

Outreach Education. Teton Science School's Outreach Department offers year-round classroom visits to schools in the Greater Yellowstone Ecosystem (Idaho, Montana, and Wyoming). TSS faculty and resident instructors present programs that involve two or three classroom visits that last one to two hours each. Again, the classroom teachers participate at many different levels, from no participation, to disciplinarian, to active participant in the program. Their level of participation is determined by their preference (full participation is voluntary) unless the visiting instructor specifically asks for assistance.

Teacher Workshops. TSS also offers teacher workshops to prepare teachers to return to their classrooms with new and innovative ideas in the field of natural science education. Teacher workshops fall under the broader category of teacher inservice training. These programs vary in focus and length, but all are designed to educate teachers and encourage teachers to incorporate EE into their classroom curriculum. Teachers attending workshops at TSS in the summer of 1995 expressed motives other than wanting to learn about EE or adopt EE curriculum into their classrooms. These motives included earning university credit, being away from home, and spending time in Jackson Hole, Wyoming (personal communication, October 28, 1997).

Based on syllabi provided by TSS faculty and this researcher's experience as an instructor at TSS, unique components of each type of program were identified. For example, the residential education programs provide teachers with background knowledge in natural science as well as demonstrating indoor and outdoor EE teaching methods. Again, students are the main focus of these programs, but the teachers are witnessing the programs being taught by accompanying their students at TSS. The following comment, provided by TSS's director of education, Nancy Shea, was quoted by a teacher upon completion of a residential education program. "Not only did I gain factual knowledge, but you gave me hope for the future by engaging and turning on the kids to a world they will one day be responsible for." Furthermore, TSS trains its

professional residents in environmental education (PREE) to teach these programs in part by having them first observe, then team teach the programs with experienced faculty. Teachers who accompany their students to TSS might also be benefitting from these programs by observing, and in a few cases, team teaching with the TSS faculty.

TSS outreach programs also demonstrate both indoor and outdoor EE teaching methods and provide background knowledge in natural science topics. These programs demonstrate that teaching about the environment does not require a costly field trip to a remote location. A study by Simmons (1993) found that the schoolyard ranked the lowest as a preferred site for EE, and teachers considered the schoolyard a site that was best suited for recreation and sports. Simmons suggested that teachers need training in what can be accomplished in the schoolyard. TSS outreach programs might help to provide this training by demonstrating EE teaching methods in a teacher's schoolyard.

According to the TSS 1997 Course Catalog, the purpose of TSS teacher workshops is "to provide continuing educational opportunities for teachers, field professionals, and interested adults." Elements unique to the workshops include obtaining curricula to be used back in the classroom and schoolyard, discussions on student management, networking with TSS faculty and other classroom teachers, and providing an enriching personal experience.

Research Objectives

The current study had three main research objectives. The first was to investigate the relationship between the three existing TSS programs described above

and participating classroom teachers' ability to teach about the environment. A mail survey was designed to assess the relationship between teachers and the three programs in general as well as the value of components that were specific to each type of TSS program. The second research objective was to identify the amount and type of EE done by the respondents in their classrooms and what components of TSS programs the respondents reported being valuable in incorporating EE into their own classrooms. The third objective was to utilize the results of the survey to recommend components of effective EE programs that will assist environmental educators in designing effective EE training for classroom teachers.

The remainder of this thesis is broken into five chapters. Chapter 2 provides a review of the literature relevant to this project and presents the research hypotheses. Chapter 3 reviews the study design and survey instrument. Chapter 4 presents sample characteristics of the survey respondents, their attitudes toward teaching EE, and development of the independent variables. Chapter 5 is the analysis of the study hypotheses. Finally, Chapter 6 summarizes the research findings, provides recommendations for designing EE programs to enhance teaching effectiveness, and presents suggestions for further research.

CHAPTER 2

REVIEW OF LITERATURE

Over the last 20 years, there has been an abundance of literature about EE. Since it is a relatively new field, however, much of the literature deals with the definition and the process of EE (Leeming, Dwyer, Porter, & Cobern 1993). Most studies of EE *programs* have focused on student knowledge and attitude changes (e.g. Bryant & Hungerford, 1977; Burrus-Bammel, 1978; Carlson & Baumgartner, 1974; Falk, 1976; Kostka, 1976; Ryan, 1991). Few studies have attempted to document the relationship between EE programs and teachers' ability to teach about the environment.

Five topic areas in the literature review were influential in the design of the current study. The first section of this chapter reviews literature that looks at students' and teachers' attitudes toward the environment and EE. These studies are based on the reasonable premise that if teachers have a positive attitude toward EE, they are more likely to teach it in their classrooms. The second section reviews literature aimed at identifying teachers' perceived barriers to implementing EE. This body of literature was extensive and revealed many important considerations for implementing EE teacher training programs. The third section examines existing literature on the evaluation of existing EE programs. This review revealed that teacher evaluation is a new and much needed field. The fourth section of this chapter is a review of the literature on teacher workshops, or inservice teacher training. Inservice teacher training includes both voluntary and mandatory educational opportunities for primary and secondary teachers.

The final section of this chapter is a review of the literature on teacher perspectives of residential EE programs.

After reviewing the literature, the following conclusions were made. Most evaluation studies in EE measure the effect of programs on students rather than classroom teachers. Specifically, very little research has been done on the evaluation of the effect of EE programs on classroom teachers. Additionally, there have been few studies that look at the *long-term* impact of EE programs on teachers and their teaching of EE in their classrooms. There have been numerous studies on the perceived barriers to EE, yet very little written on ways to break through these barriers. Finally, the literature review revealed the importance of providing effective EE training to classroom teachers. These conclusions and the experience of instructors and faculty at TSS, including this researcher, led to the research questions and study design.

Teacher and Student Attitudes Toward Environmental Education and the Environment

If two of the major goals of EE are to develop students' attitudes toward the environment and to provide information on the environment, a clear first step is to train teachers who are committed to teach EE in their classrooms. The existing literature explores several questions relating to these goals. Among them are: 1) do education programs have an effect on students' concern for the environment?; 2) do teachers possess a positive attitude toward EE?; and 3) are they committed to teaching EE?

A study by Palmer (1993) looked at the relationship between childhood

experiences and developing a concern for the environment. She found that education programs, at the secondary level in particular, had a significant influence on the lives of the students as adults. Unfortunately, it is believed that if teachers possess a negative attitude toward teaching EE, then little or no EE will occur in their classrooms (Jaus, 1978). Fortunately, Jaus found that teachers, after receiving training in EE, possessed significantly more positive attitudes toward EE than teachers who did not receive training. Jaus's study looked at the effectiveness of 30 hours of EE instruction on teachers' attitude toward teaching about the environment in their classrooms by comparing an attitude measure between an experimental and a control group. The experimental group received instruction in science process skills and training in EE methods and scored significantly higher on the attitude measures. Also of interest in this study is the different scores on two attitude statements in particular. For the statements, "I plan on teaching environmental education to my students," and "I plan on spending a good deal of time teaching environmental education to my students," the mean score differences between the experimental and the control groups were significant at the 0.001 level. Both of these statements indicate a commitment to teaching EE in the classroom, but no assessment of how much EE is done in the classroom by these teachers was done.

TSS programs also provide instruction in science and EE teaching methods to classroom teachers who then leave these programs with very positive attitudes toward EE. Nancy Shea, director of education at TSS, says, "No doubt about it, the evaluations of our teacher workshops are almost always positive." She further explained that the

only negative comments refer to the food, weather, or possibly that the content is not readily adapted to a particular grade level (personal communication, October 28, 1997). Although TSS has the luxury of tracking a few of its teacher workshop participants, most leave without TSS knowing how much EE will be done by the teacher participants. Quotes from 1997 teacher workshop participants provided by TSS include, "It was all wonderful. It put me in touch with myself and nature. Because of this internalized experience, I want to share the magic and wonder I experienced with others." Another teacher said, "I will now spend more time outside with my students and we will all grow and benefit from it." Again, this indicates a positive attitude and verbal commitment to teaching EE without knowing how much EE instruction is actually. The current research is a step toward trying to fill this gap and measure EE in the classrooms following these programs.

A difficulty in the implementation of EE is that it is rarely part of the mandated curriculum. McCaw (1979) found that many teachers possess the attitude that EE can only come after the basics, reading and math, are taught. McCaw surveyed teachers in Columbus, Ohio as part of a study of the feasibility of establishing an EE program in the public schools in the Columbus area. One of the study objectives was to determine teachers' priorities regarding EE and other "non-basic" parts of the curriculum. Six of the teachers in his study wrote comments on their questionnaires indicating that the basics, reading and math, must come first, and many others, including administrators, shared this attitude. Other teachers felt that consumer and vocational education must come first over EE. McCaw felt that EE will only happen in the schools if it is shown

that these programs are relevant to all facets of the curriculum and can enhance teaching of the basics. According to TSS course syllabi, one of the goals of TSS EE programs is to incorporate other facets of the curriculum including art and literature, basic concepts of ecology, and research methods.

This raises the question: *Why are some teachers more committed to teaching EE than others?* One theory is that teachers' commitment to teaching EE results from significant life experiences as well as to beliefs and attitudes about EE (Shuman & Ham, 1997). Identifying significant life experiences that influence a person's commitment to the environment, whether these experiences are spending time outdoors, reading books about the environment, witnessing disasters or negative environmental impacts, or taking part in an educational program that focuses on the natural world, may be valuable in identifying and developing effective teacher training programs.

Shuman and Ham (1997) explored four areas of existing research and theory to explain how a commitment to teaching EE could originate. The four areas were field theory, the theory of planned behavior, life-span development theory, and research on life experiences that influence environmentally responsible behavior. *Field theory* states that behavior is a function of the person and the person's environment, but it does not consider the role of past experiences. If field theory is applied to EE, teaching environmental education is a function of the teacher and the school environment without taking into account the role of historic causation in current and future behavior. *The theory of planned behavior* is based on the assumption that teachers use available information and plan certain voluntary behavior. This theory does take into

consideration the role of the person's attitude toward the behavior. The authors further state that external factors such as inservice workshops, time spent on field trips, and other events in teacher development may have an impact on attitudes toward the planned behavior. According to Shuman and Ham, these external factors might include experiences such as participation in EE programs at centers like TSS.

The life-span development theory "seeks to predict, explain, and optimize changes in behavioral responses as a consequence of life events as they occur over a long period of time" (Shuman and Ham, 1997, p. 28). One of the central ideas of this theory is that life-span development is a lifelong process, although it includes "critical incidents" and "early recollections" as life events. "Critical incidents" are those that have a great impact on a person and that appear important to an outsider. TSS programs have been described by teachers as, "an internalized experience," " one of the most exceptional learning experiences I've had," "an enriching experience," " ...will stay with me a long time," and "magic and wonder." It could be argued that these experiences had a great impact on those teachers. A wide range of *life experiences* was identified by looking at autobiographies of key conservationists such as Leopold and Olson that included spending time outdoors as a child and the influence of teachers at different times in life. Although this theory is not particularly useful in identifying short-term experiences such as program participation at TSS as having an impact on teachers' commitment to teaching EE, it does support the importance of the influence of teachers on students at different times in their lives. Also, education courses were identified as one of 13 categories of life experiences that may lead a person to have a "practical concern for the

environment," and this concern may lead to activities such as curriculum development in EE.

The next section explores what has been called the barriers to EE. Obviously, attitude and commitment alone are not good predictors of whether or not teachers will teach EE in their classroom. Barriers exist that intervene between teachers' positive attitudes and commitment toward EE and the implementation of EE in their classrooms.

Barriers To Environmental Education

Ham and Sewing (1987) categorized the barriers of implementing EE into four broad groups: conceptual barriers, logistical barriers, educational barriers, and attitudinal barriers. Conceptual barriers stem from the lack of consensus about the scope and content of EE (Ham & Sewing, 1987). One misconception about EE is that it is relevant only to science curricula. In fact, this misconception was encountered in the implementation of the current research project.

Logistical barriers are those stemming from transportation constraints, a lack of time, funds, resources, etc. McCaw (1979) ranked transportation and money as the top two factors worrying teachers who took study trips with their students once a year or more. Time is also an important barrier, because it includes time for curriculum development, preparation time, and class time. Many teachers argue that EE means taking costly (both time and money) field trips, even though field trips are just one of the many avenues available for teaching EE.

Educational barriers result from teachers' misgivings about their own ability to

teach EE. Attitudinal barriers stem from teachers' attitudes about EE. It is believed that if teachers do not possess a positive attitude about EE, very little instruction in this area will be conducted (Jaus, 1978). These themes were found in several studies.

Incorporating EE into school curricula is a continuing problem in education (Disinger, 1989; Stone, 1989). It has been found that although teachers may have a positive attitude toward EE, many may still lack the commitment to actually teach EE (Ham & Sewing, 1987). This lack of commitment has been attributed to a lack of time both in the school day and in preparation, a lack of funds, a lack of knowledge about the environment, a lack of training, safety concerns, and a lack of materials or an appropriate site for conducting EE (Buethe & Smallwood, 1987; Lane et al. 1994; Simmons, 1993). Other barriers also include the concern that EE has the potential of being disruptive to the school's schedule, and that it is not the responsibility of classroom teachers to provide EE (Simmons, 1987). Samuel (1993) also found that teachers have a difficult time defining EE, and although teachers had an understanding and knowledge of current environmental issues, they did not know how to relate EE to their subject areas.

One study looked at urban teachers' perceptions of different outdoor settings and what EE activities they could conduct in those settings (Simmons, 1993). The author suggested that teachers need training in activities and lessons that can be accomplished in different settings. The school site was one setting included in the study. It is important for teachers to realize that EE can be accomplished right in their own schoolyard. A study of the factors influencing the use of outdoor classrooms found the inability to recognize the school site as a teaching area to be one of the major reasons teachers do

not use outdoor classrooms (Mirka, 1973).

This literature documents some of the barriers to the implementation of environmental education. The next question is: *Will teachers incorporate EE into their classrooms if these barriers are alleviated, and they are provided with effective EE training, tools, and opportunities?* A logical next step is to evaluate some of the existing programs that are designed to teach EE to classroom teachers. TSS, for example, might be helping to reduce educational and conceptual barriers by providing natural science instruction that is appropriate for many subject areas. TSS programs might also be helping to alleviate the attitudinal and logistical barriers by providing curriculum and teaching ideas that do not require costly (both time and money) field trips. The following section provides a review of the literature on the evaluation of EE programs.

Evaluation of Environmental Education Programs

EE programs must be assessed in order to measure effectiveness, provide guidance for future efforts, determine what needs to be changed, comply with funding sources, and promote programs (Thomas, 1989). Most evaluations of existing EE programs focus on the impacts on the students rather than on teachers (Armstrong & Impara, 1991; Gutierrez de White & Jacobson, 1994; Kostka, 1976; Morgan, 1992). Scientific/analytic approaches are the dominant model of evaluating the effectiveness of EE programs; they evaluate the congruence between goals and outcomes (Robottom, 1985). Learners are pretested and posttested and shifts in performance are measured.

For example, one study conducted by Armstrong and Impara (1991) evaluated the effects of *NatureScope*, a K-7 EE supplement developed by the National Wildlife Federation on fifth- and seventh-grade students. Teachers were selected on a voluntary basis and allowed to use the *Nature Scope* issues they preferred most. There was no control on the number of activities required by the study. Teachers were allowed to modify the activities and select their own method of implementation. Through pretests and posttests they found that, in general, students gained environmental knowledge following exposure to this program. There is still a need, however, for determining why teachers do or do not choose to incorporate programs like *Nature Scope* in their curriculums.

Few researchers collect follow-up data to determine if observed effects of EE programs on students or teachers persist over time. Classroom teachers and administrators will be more interested in utilizing EE techniques that have been shown to have a lasting effect (Leeming, Dwyer, Porter, & Cobern, 1993). A 1993 review of EE evaluation included two studies that measure long-term impact. In one study, the students who received EE instruction as third graders were tested again in fifth grade and continued to show significantly more positive attitudes toward the environment than a control group (Leeming et al.).

Studies have also been done to determine how EE programs should be evaluated (Niedermeyer, 1992; Robottom, 1985, 1989). Niedermeyer (1992) offered a checklist for reviewing or developing EE programs that are intended to help identify well developed, effective instructional programs in EE. He also included some programs that

fit all of the characteristics in the checklist. He acknowledged the fact that effective EE programs do exist, but recognized the need for educators to recognize and use these programs.

Current practices in the evaluation of residential environmental education programs were investigated by Chenery and Hammerman (1984). This study identified methods used to evaluate programs at 144 outdoor centers nationwide. These centers included camps, conference centers, and environmental centers similar to TSS. The purpose of the study was to identify promising evaluation techniques and tools and to share this knowledge with practitioners of EE. They found that most evaluations focused on the operational aspects of the program (food service, sleeping arrangements, etc.) and the students' overall satisfaction with the program. Although programs were found that also evaluated teachers' overall satisfaction with the program, the relationship between classroom teachers' participation in these programs and use of EE in their own classrooms was not measured. To help meet this need, the current study included participants of TSS residential programs who were classroom teachers at the time of their participation.

The Need for and Evaluation of Teacher Workshops

The EE teacher workshop, or inservice teacher training, has been identified by professional environmental educators as one of the most important needs of curriculum development in EE (Stone, 1989; Volk, Hungerford, & Tomera, 1984). Inservice training is taught to teachers who already have classrooms (preservice education is

taught to education students while they are still in college) and takes a wide variety of forms, from 4-week summer courses to single-day symposiums, with topics ranging from energy and population to broader environmental subjects (Rakow, 1985). The goal of teacher workshops is to write and present curriculum packages that teachers can use in their classrooms (Hanley, 1994).

Although studies have been done to determine the type of inservice programs that should be offered (Ritz, 1977), few studies were found to test the long-term effect of existing inservice efforts on incorporating EE. Ritz identified seven characteristics that he believes are vital to EE inservice. The characteristics are: providing basic science as needed; being appropriate for teachers with a variety of backgrounds; providing training in the methods of teaching EE; having a strong motivational impact on the participants; encouraging teachers to environmentalize their teaching in general; bringing teachers into direct contact with the environment under consideration; and engaging teachers to explore their own personal assumptions, values, and feelings about society and self, and the relationship to the natural world. He then described two workshops taught at his Environmental Studies Institute that incorporated the seven characteristics. Although this is a critical first step in designing effective inservice training, this study did not go beyond asking teachers to commit to making changes in their personal habits that impact the environment.

A study of elementary and secondary education teachers in Wisconsin found that, although attitudes toward EE were positive, teachers spent less than one half hour per week per subject teaching about the environment (Lane et al. 1994). When asked why, a

lack of an EE background and the belief that EE is unrelated to their disciplines were given by teachers as the main reasons for this finding. When asked what would influence them to teach EE, almost a third of the teachers surveyed said inservice training. Further analysis of the data revealed that the more inservice training teachers receive, the more time they spend on EE in their classrooms, especially if the programs are providing background knowledge in EE *and* ways of implementing EE across the curriculum. Many of the TSS programs are designed to do both of those things. Lane et al. suggested that further research be done to investigate to what extent teacher education programs are meeting the EE needs of classroom teachers.

Another Wisconsin study found that elementary and secondary education teachers in that state reported attending effective EE courses, but they were not receiving adequate instruction in some EE teaching methods, specifically classroom techniques and environmental action strategies (Lane et al. 1995). Again, further research was suggested, specifically looking at how effective inservice teacher training in EE is at addressing all components of EE including affective (pertaining to emotion) education teaching methods and environmental action strategies.

There were no studies found that compared teacher inservice programs to outreach or residential student programs, or studies that looked at the relationship between outreach or residential student programs and teachers' ability to teach EE. The extent to which outreach and residential education programs benefit classroom teachers adds to their value to school children who benefit not only from the original programs, but also from their classroom teachers' use of EE in the classroom after the program.

Many existing EE programs, including inservice, are residential experiences requiring teachers to spend the night away from home, often with their students. In order for these programs to be successful, it is important to understand whether or not teachers are committed to spending time away from their families, homes, and jobs to be a part of these programs. The following section looks at teacher perspectives of, and commitment to, participating in residential EE programs.

Teacher Perceptions of Residential Environmental Education Programs

Simmons (1987) surveyed teachers participating in a residential EE program at the New Jersey School of Conservation to determine their perceptions of the experience. She investigated a number of topics including what the teachers view as personal benefits and drawbacks to participation in these programs, teacher training and support needs, and what role teachers felt EE played in their school curriculum. Simmons suggested that understanding the teacher's perspective on what role EE plays in the school curriculum provides an idea of why they choose to participate in a resident program.

Simmons found several reasons why teachers choose to participate in residential EE programs. One reason was the opportunity to provide a positive experience for their students. Teachers also acknowledged the benefits of personal and social growth, personal challenge and the opportunity to learn about the environment, the enjoyment of being in the outdoors and the experience itself. It is important to realize that by providing teachers with personal benefits, the residential program may also play an important role in maintaining teachers' enthusiasm for EE. Simmons addressed the need

to further explore this idea and the ability to nurture this sense of growth both at residential facilities and in the schools. The teachers in Simmon's study also identified the need for more training, including the opportunity to watch others teach in an outdoor environment.

Summary

Previous literature in the field of environmental education was very important in the development and implementation of this research project. The most influential finding of the literature review was the lack of research that has been done on teacher training in EE. Obviously, there is a need for more studies that measure long-term impact of EE programs, specifically those designed for classroom teachers. If we expect teachers to implement EE in their classrooms, then we need to provide effective instruction in EE. The current research was an attempt to contribute to this much needed area of research. Data were collected approximately one academic year after teachers participated in TSS programs, thus allowing time for them to implement EE in their classrooms. The idea of measuring and comparing the relationship between three different EE programs and classroom teachers is a new one. Numerous studies were found measuring attitudes toward EE, barriers to bringing EE to the classroom, teacher workshop needs, and the short-term impact on student participants, but few researchers collect follow-up data to determine if observed effects persist over time. Very few studies looked at the long-term impacts of EE programs and their components on teachers' attitudes, teachers' knowledge of the environment, and teaching of EE in the

classroom, but many of these studies identified the need for this type of research.

The previous literature also provided examples and awareness of methodological problems that needed to be addressed. One difficulty in determining the effectiveness of EE training is attempting to isolate the effect of one EE program from other experiences. Jaus (1978) addressed this problem by testing an experimental and a control group in his study. Jaus was also able to conduct pretests and posttests to measure the effect of EE programs on the study participants. Ideally, this type of research requires an experimental design, but for the current study, experimental design was not a practical approach due to financial and time limitations and the characteristics of the participants of TSS programs. Because of the registration procedures at TSS, teacher participants are not usually known a year in advance, thus pretesting is not possible. Also, experimental design requires random assignment to control and experimental groups (Neuman, 1994). This was not possible because teachers could not be assigned to attend or not attend TSS. Another consideration in the decision not to use an experimental design is the understanding that attitudes expressed in a posttest are not a measure of behavior, or in this case, a measure of EE taught. Thus, it was decided to use a one-time survey instrument, one year after the experience, that asked attitude and behavior questions and to control for type of program experience.

A final consideration based on the review of the literature is the difficulty in demonstrating the influence of one EE program on teachers given the variety of other potential influences. Schutt (1996) identified four criteria for determining a nomothetic causal relationship: association, time order, nonspuriousness, and mechanism. There is

association when variation in one variable is related to variation in another variable. *Time order* means that variation in one variable must occur after variation in the variable said to be the cause. *Nonspuriousness* refers to a relationship that is not due to variation in a third variable called an extraneous variable. *Extraneous variables* may cause a *spurious relationship* between the independent and dependent variables. Finally, a *mechanism*, or a recognizable means of creating a connection, must be identified. Both an experimental and, if carefully applied, a nonexperimental approach can be taken to establishing a causal relationship (Schutt, 1996). The current research utilized a nonexperimental approach and, through a survey, measured a variety of respondents' characteristics, attitudes, and behavior without any other intervention in their lives. This study will be concerned primarily with establishing a relationship.

Research Questions

This research was a survey of classroom teachers who have participated in TSS programs to assess to what extent they incorporate environmental education into their classrooms and the relative effectiveness of the three TSS programs on teachers. Research questions were generated based on the literature review and observations made while teaching at TSS. These questions support the old adage "Don't tell me, show me." Literature from the National Outdoor Leadership School says it best with "What I hear, I forget; what I see, I remember; what I do, I know" (Manning, 1996). The primary research questions were:

- *What are the characteristics of TSS classroom teacher participants?*

- *Is there a relationship between residential education programs at TSS and teachers' ability to teach about the environment?*

Chapter 4 answers the first question by presenting the participant characteristics and attitudes toward teaching EE. It is important to realize that the survey respondents are not a representative sample of classroom teachers. The respondents are teachers who voluntarily participated in TSS programs during a specific time period.

In developing research to explore the second question and in observing teachers' experiences at TSS, it was hypothesized that *residential education programs at TSS, although designed for students, help teachers to incorporate EE into their own classrooms.* This hypothesis is based on observations made while at TSS, and is what prompted the literature review and research design. The survey was designed to explore this research question and also to compare the relationship between the three TSS programs and participating teachers. TSS residential education programs may help classroom teachers by alleviating some of the barriers described by Ham and Sewing (1987) that are associated with teaching EE. Residential education programs taught by TSS faculty provide teachers with background knowledge in the natural sciences, possibly reducing what is considered an educational barrier, and they demonstrate EE teaching methods appropriate to many academic disciplines and locations, possibly reducing the conceptual and logistical barriers. Outreach programs were explored because they might also help teachers for the same reasons residential education programs are believed to. Teacher workshops were also explored for a comparison of residential education programs and outreach programs to programs *specifically designed*

to increase teaching of EE. This comparison can provide an idea of the relative value of the different programs as well as a broad picture of what the ideal teacher training program should include.

The design of the survey instrument allowed the development and exploration of secondary research questions. Secondary research questions were:

- *Which of the three types of TSS programs do teachers find the most useful for adapting EE into their classrooms?*
- *Which components specific to each of the three types of TSS programs do teachers find the most useful for adapting EE into their classrooms?*

One of the Teton Science School's educational premises is "we don't talk about it if we can do it." One component of the residential education programs and outreach programs is that teachers directly experience EE with their students. It is the experience of TSS graduate students and staff, including this researcher, that observing TSS faculty teaching was the most beneficial part of the TSS graduate program. Nothing prepared this researcher more for teaching about the environment at TSS and other centers more than this component.

There are several definitions and constructs that are important for understanding these research questions. Identifying a **relationship** will be done using attitudinal variables including teachers' attitudes toward EE (do teachers feel it is their responsibility?), comfort with EE methods, and how they value TSS programs. Relationship will also be measured using behavioral variables including how much EE is done in a teacher's classroom, teaching style (do teachers take their classes outside, do

they role play, do they do environmental research projects?), and curriculum modification (do teachers use supplemental curricula to teach about the environment?).

Components of the three types of EE programs are specific aspects of the programs that may help teachers incorporate EE into their classrooms. The components were identified after discussion with other TSS instructors and conversations with teachers while visiting TSS. It is important to identify and measure these components in order to make recommendations for future teacher training in EE at TSS and other centers.

Components specific to the three types of TSS programs are illustrated in Figure 1. *Application of scientific method* refers to using a research approach to answering a question based on observations made about a natural science topic and is a component of all three types of TSS programs. *Observing TSS staff teach outdoors at TSS* is a component of the residential programs and refers to the ability of teachers to observe their school children being taught by TSS instructors in a field setting. Another component unique to the residential programs is *observing TSS staff teach in a TSS classroom*. The last two components, and *observing a role play at TSS*, allow teachers to observe both the content of the lessons and the teaching methods being used. *Spending time outdoors at TSS* is a large part of both residential programs and teacher workshops and was identified by Simmons (1987) as one reason teachers enjoy attending residential programs and a personal benefit to these programs.

Three of the components specific to TSS outreach programs are the opportunity to *observe TSS instructors teach in a teachers' classroom, observe TSS instructors*

teach in a teacher's school yard or community, and observe a role play in a teacher's classroom. These are all opportunities for teachers to observe EE teaching methods that can be done at their own school.

Teacher workshops allow teachers the opportunity to *obtain new curriculum* that is often designed to target specific core objectives and is suitable for the classroom or school yard. *Problem solving with other educators* allows teachers the opportunity to share both positive and negative experiences, and adapt curriculum and methods to their specific needs. *Networking with professionals* also provides teachers with the opportunity to learn from other teachers as well as experts in the field of EE. The following chapter provides a discussion of the survey design and research methods.

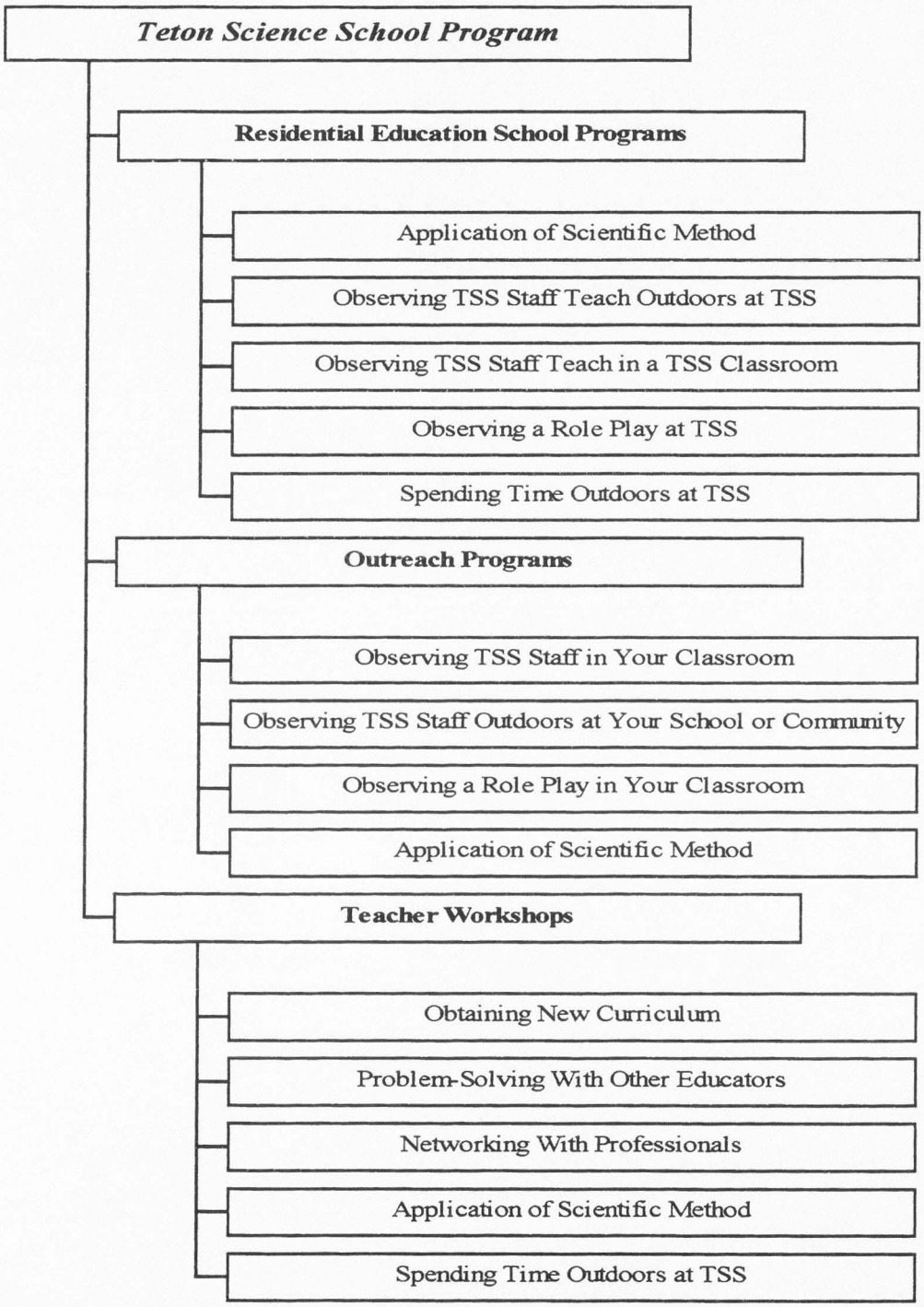

FIGURE 1. Teacher Training in Environmental Education Study: Program Components

CHAPTER 3

RESEARCH DESIGN

To explore the study questions, a survey was designed and mailed to elementary and secondary education teachers who had participated in at least one of the three types of EE programs at TSS: residential programs, outreach programs, or teacher workshops (see Appendix A). Access was obtained to the Teton Science School's database to collect participant information. A search was conducted for adult participants for the time period of July 1, 1994 to September 1, 1995. During this time, the curriculum was consistent and taught by the same group of TSS instructors and faculty. This also allowed teachers one year after their participation at TSS to implement EE in their own classrooms, schoolyards, and communities before completing the survey. Instead of taking a random sample of participants, the survey was mailed to the entire population of classroom teachers who participated in the programs during this time period.

Separate searches were conducted for each of the TSS programs that classify as residential programs, outreach programs, or teacher workshops. Participants' names, home and/or school addresses, and program attendance were available in the database. Whether or not the adult participants were classroom teachers and not adult chaperones was not always documented in the database and had to be verified with several TSS faculty and staff members. Any names that could not be verified were kept on the participant list and sent a survey. A question was added to the beginning of the survey asking if the participant was currently a classroom teacher. If the participant answered

no, they were not considered in the results.

There were 11 high school teachers who participated in residential education programs during the selected time frame. These teachers were sent a pilot of the survey instrument. Minor revisions were made based on the results returned by three teachers.

The survey was distributed following The Total Design Method (TDM) (Dillman, 1978). Extensive use of the TDM has shown that a response rate of 75% can be consistently attained in mail surveys of the general public and even higher rates from more specialized populations.

Two ethical considerations in survey research are the invasion of privacy and informed consent (Neuman, 1994). All efforts were taken to keep the names of survey recipients confidential, and it was the right of the survey recipients to choose to complete or not complete the survey. Survey recipients were provided with information on the importance and the purpose of this study and assured that their responses will be kept confidential (see Appendix A).

The survey instrument consisted of five sections: 1) teaching experience, 2) attitude toward teaching about the environment, 3) amount and type of teaching about the environment done in the classroom, 4) participation in TSS and other programs, and 5) demographics. Through the survey, the participants were questioned extensively about their attitude toward EE and the amount of EE done in their classrooms, the EE methods they utilize, and where they teach about the environment. The survey also asked questions about the participants' background and participation in EE programs at centers other than TSS to assess their EE knowledge. Survey questions were written

following a Likert scale design (Neuman, 1994, pp. 153-156). Prior to mailing, the survey was reviewed by individuals at Utah State University and Teton Science School.

The initial mailing of 241 surveys was conducted on November 20, 1996. One survey was mailed to every teacher who participated in one of the three TSS programs during the selected time frame. A cover letter and return envelope with first class return postage accompanied each survey. Surveys were marked with a number to identify those who had or had not responded.

One week following the initial mailing, a reminder postcard was sent to all of the participants who had not responded (see Appendix B). The postcard thanked them if they had returned the survey or requested that they complete the survey. On January 3, 1997, a second cover letter (see Appendix C), a replacement survey, and a return postage paid envelope were sent to the participants who still had not responded.

Shortly after the second mailing, two teachers called the phone number on the survey cover letter. Both of these individuals questioned their participation in the study because they were not science teachers. One of these individuals was representing several other teachers at her school who also were not science teachers but had received the survey. Both of these teachers explained that they do not teach about the environment often, because it is not appropriate or applicable within their subject areas. One asked if she should pass the survey along to the science teacher in her grade who did not receive the survey. Both of the callers and their colleagues were encouraged to complete and return the survey themselves. One of the callers returned the survey shortly after the phone call.

Of the 241 surveys mailed, 8 were undeliverable and 28 were returned by participants who were not currently classroom teachers. The eight undeliverable were deducted from the sample size. Of the 233 remaining, 124 were returned complete, and 4 were returned by respondents who reported that they had not participated in TSS programs. The final response rate was 67%.

The following chapter, through descriptive statistics, provides sample characteristics of the survey respondents and their attitudes about teaching EE. The development of the independent and dependent variables that are used to test the study hypotheses is also discussed.

CHAPTER 4

SAMPLE CHARACTERISTICS, ATTITUDES ABOUT TEACHING EE, AND DEVELOPMENT OF INDEPENDENT VARIABLES

As can be seen in Table 1, the study involved teachers from the preschool level through high school. Study participants had been teaching from 1 year to 40 years and represented teachers who teach all subjects. Twenty-seven percent listed science as their primary subject area. Given the phone calls received from the non science teachers, this is a potential source of sampling bias, and the entire survey population may have included a smaller percentage of science teachers. The majority of participants were female, taught at public schools, and held at least a bachelor's degree with 52% having completed courses beyond the bachelor's. Over two-thirds of the teachers reported taking college-level environmental education courses, and 29% indicated they were members of organizations that tried to educate members of the public on issues related to the environment. Based on their responses to the *age* and *number of years teaching* questions, most of the survey respondents were in the middle of their teaching careers.

Amount and Type of EE Taught by Survey Respondents

Participating teachers were asked a series of questions about the amount and type of environmental education done in their classrooms, schoolyards, and communities. Using the following definition of environmental education in the survey as a guide, teachers were asked if they currently teach about the environment.

TABLE 1. Summary of Selected Characteristics of Survey Respondents [a]

Category	n	%
Gender		
Male	43	34.4
Female	82	65.6
Age		
Under 30	4	3.2
30-39	40	31.7
40-49	52	41.3
50-59	29	23.0
60-69	1	.8
Years in teaching		
1-5	13	10.2
6-10	27	21.1
11-20	53	41.4
21-30	27	21.1
31-40	8	6.3
Type of school		
Public	121	96.0
Private	5	4.0
Grade level		
High school	16	12.5
Middle school	37	28.9
5th grade	29	22.7
Elementary Combination	45	35.2
Preschool	1	.8
Subjects taught		
All subjects	76	59.4
Science only	35	27.3
Other	17	13.3
Highest degree completed		
Bachelor's	61	48.4
2+ Bachelor's	12	9.5
Master's	46	36.5
2+ Master's	4	3.2
PhD	3	2.4
Taken college level EE courses		
Yes	84	68.9
No	38	31.1
Members of environmental organizations		
Yes	37	29.4
No	89	70.6

[a] Percentages exclude the missing values (there were no more than 3 non-responses for any given variable).

Environmental Education:

- concerns the interconnectedness between humans and the surrounding world;
- teaches about the natural processes which take place in the environment;
- recognizes that natural resources are essential for human activities, but at the same time are limited;
- is a process aimed at teaching students about environmental issues and the tools they need to solve and prevent environmental problems;
- can be taught both in formal and informal settings using a broad range of teaching and learning techniques;
- is concerned with building an environmental ethic.

Approximately 88% of the teachers reported teaching about the environment "often" or "sometimes" while only 10% reported "rarely" or "never" teaching about the environment (Table 2). Those that reported "never" teaching about the environment gave the following reasons: "I am an inclusion teacher. I work with students with disabilities in the regular classroom. We work on the classroom curriculum and individual students' goals and objectives;" "not part of my curriculum;" and "I am an English teacher."

Two questions asked about the time spent outside to teach about the environment and subjects other than environmental education. Thirty-four percent of teachers reported going outside with their students to teach about the environment "once or twice a month," while 33% reported going outside "once or twice a term" (Table 2).

TABLE 2. Amount of Teaching About the Environment Done by Respondents [a]

Category	n	%
Teach about the environment		
Often	61	47.7
Sometimes	52	40.6
Rarely	10	7.8
Never	3	2.3
Outside to teach EE		
More than once a week	5	4.0
Once a week	5	4.0
Once or twice a month	42	33.9
Once or twice a term	41	33.1
Once or twice a year	24	19.4
Never	7	5.6
Outside to teach subjects other than EE		
More than once a week	3	2.4
Once a week	6	4.9
Once or twice a month	24	19.5
Once or twice a term	52	42.3
Once or twice a year	23	18.7
Never	15	12.2

[a] Percentages exclude the missing values (there were no more than 5 nonresponses for any given variable).

Six percent reported "never" going outside to teach about the environment, and 12% reported "never" going outside to teach subjects other than environmental education. Forty-two percent of teachers reported going outside to teach subjects other than environmental education "once or twice a term."

Survey teachers were asked to describe what activities/lessons they do with their students outside. There were several outdoor activities listed by the teachers, indicating an abundance of creativity. The activities ranged from simply reading to students outside

on a nice day to conducting an egg drop contest using the local police helicopter. The most common environmental education activities mentioned included animal and plant identification, habitat studies, gardening, water quality monitoring, weather observations, litter pick-up, and *Project Wild, Project Wet, and Project Learning Tree* activities. The most common lessons conducted outside to teach subjects other than environmental education included games, orienteering and mapping activities, art projects, and physical education activities.

Three questions were asked to measure the survey teachers' attitude toward environmental education (Table 3). On the whole, the results indicate that the teachers have a positive attitude toward environmental education. Although one survey teacher wrote, "Teachers have a responsibility to teach about the environment only if it is in the district standards," 89% of the teachers reported that they "agree" or "strongly agree"

TABLE 3. Respondents' Attitude Toward Environmental Education[a]

Category	n	Mean	Standard deviation	% Agree or Strongly Agree[b]
Teachers have a responsibility to teach about the environment	122	4.31	1.02	88.8
EE can be integrated into many subject areas	122	4.24	1.00	84.0
EE can be integrated only in science	122	1.66	1.05	8.8

[a] Attitude questions are based on a 5-point Likert-type scale; 1 represents a negative response (strongly disagree) and 5 a positive response (strongly agree).

[b] Percentages exclude the missing values (there were no more than 3 non-responses for any given variable).

with the statement *teachers have a responsibility to teach environmental education*. Eighty-four percent "agreed" or "strongly agreed" that EE can be integrated into many subject areas while only 9% "agreed" or "strongly agreed" that EE can only be integrated into science. One teacher wrote, "I rarely teach EE because my school departmentalizes and science is taught by another teacher." On the other hand, a teacher wrote, "Although I am an English teacher, and can't directly apply acquired environmental learnings to my daily English classes, I can help students to develop an appreciation and understanding of different ecosystems and how we fit in the greater picture."

Table 4 shows how often the survey respondents reported using various teaching methods to teach about the environment. The more traditional methods, *utilizing audiovisuals* and *lectures*, were reportedly used more often than other methods. *Case studies* (looking at real environmental issues, for example, the reintroduction of the wolf to the Greater Yellowstone Ecosystem), as a method of teaching about the environment, were reportedly used the *least*. This is not surprising due to the time required in investigating case studies and the fact that many teachers avoid discussing local issues that might be considered controversial. Furthermore, in a later survey question, the ability to investigate and use case studies was identified as a weakness teachers had concerning their teaching about the environment.

In general, there does not appear to be a dominant method utilized to teach about the environment with the possible exception of *lectures* and *audiovisuals*. Also, all of the teaching methods presented in the survey have a mean score of 2 (1-3 times per year)

TABLE 4. Respondents' Use of Specific Methods for Environmental Education [a]

Category	n	Mean	Standard deviation	% 11+ times per year
Role-playing	119	2.30	1.02	10.9
Audiovisuals	122	3.30	1.01	35.2
Lectures	123	3.26	1.11	41.5
Research projects/experiments	123	2.88	1.08	28.4
Guest speakers	124	2.16	.68	.8
Journals	121	2.50	1.25	19.8
Field trips	123	2.42	.84	9.0
Individual projects	122	2.43	.82	7.4
Group projects	121	2.63	.88	14.0
Observations	120	2.81	.94	16.7
Case studies	117	1.70	.73	.9
Games	121	2.43	1.00	14.1
Conflict resolution exercises	123	2.08	.86	5.7
Environmental issues investigations	120	2.18	.92	5.8
Supplemental curricula	108	2.62	1.23	21.3

[a] Teaching Methods questions are based on a 5-point scale; 1 represents never, 2 represents 1-3 times per year, 3 represents 4-10 times, 4 represents 11-20 times, and 5 represents >20 times per year.

or greater with the exception of *utilizing case studies* (1.70), indicating that the respondents were utilizing a variety of methods to teach about the environment.

Respondents were also asked to indicate how comfortable they were with their knowledge of techniques important for teaching about the environment (Table 5). For

the most part, the teachers reported being "comfortable" with the components listed. Both *knowledge of the scientific method* and *taking students outside* were especially high. The method with the smallest percentage in the "very comfortable" category was *teaching from case studies*, which may explain its low score in how often it was used as a method to teach about the environment in Table 3.

An open-ended survey question asked teachers to describe any additional weaknesses they had concerning their teaching about the environment. A lack of time to research and prepare lessons as well as time to fit additional curricula into the school day

TABLE 5. Respondents' Comfort Level with Aspects of Environmental Education[a]

Category	n	Mean	Standard deviation	% Very Comfortable[b]
Knowledge of natural processes	122	2.07	.95	34.4
Knowledge of the scientific method	124	1.86	1.00	49.2
Knowledge of environmental issues	124	2.08	.86	28.2
Role-playing with students	124	2.48	1.19	25.8
Assigning research projects	124	2.22	1.11	30.6
Taking students outside	124	1.98	1.13	42.7
Assigning group projects	124	2.08	1.02	34.7
Teaching from case studies	119	2.89	1.04	12.6
Using games for teaching	123	2.27	1.15	30.1
Assigning conflict resolution exercises	123	2.69	1.01	15.4

[a] Comfort questions are based on a 5-point Likert-type scale; 1 represents a positive response (very comfortable) and 5 a negative response (very uncomfortable).

[b] Percentages exclude the missing values (there were no more than 9 non-responses for any given variable).

was the most commonly reported weakness. Other commonly reported weaknesses included a lack of knowledge of environmental issues, a concern with being "too environmental," the belief that teaching about the environment is inappropriate for their subject area, and the inability to take students outside to teach. These themes were found throughout the literature describing the *barriers to EE* discussed earlier in the literature review. One teacher identified several of these barriers by commenting, "I believe in multiple use and politics can be a pain. Time, assessments, core curriculum, and other mandates take priority at this time."

Finally, Table 6 documents the survey teachers' participation in environmental education programs both at Teton Science School and other environmental education facilities. The participation statistics represented in Table 6 are also the basis for the independent variables of this study. Sixty-one percent of the teachers participated in one of the three types of Teton Science School programs one or more times while the rest of the respondents participated in some combination of the programs during the 5 years prior to the survey.

The teachers were also asked to report the total number of times they participated in each of the TSS programs in the last 5 years. Total involvement ranged from "low" (1 visit to TSS) to "extensive" (>20 visits as a participant in one or more of the three types of programs). Almost 10% of the teachers ranked "extensive" in involvement (8-20 visits), while 34% of the teachers ranked "high" in involvement (5-7 visits). This is not a surprise, because many of the survey respondents brought their students to TSS every year for residential education programs, and according to Nancy

TABLE 6. Respondents' Participation in Environmental Education Programs[a]

Category	n	%
Teton Science School Participation		
Single program participation		
Residential education only	22	18.0
Outreach only	19	15.6
Teacher workshop only	36	28.0
Combination program participation		
Residential education and outreach	7	5.7
Residential education and teacher workshop	6	4.9
Outreach and teacher workshop	23	18.9
All three programs	9	7.4
Program participated in most recently		
Residential education program	40	32.5
Outreach program	37	30.1
Teacher workshop	44	35.8
Total TSS involvement (mean = 3.95 visits)		
Low (1 visit)	34	26.6
Medium (2-4 visits)	35	27.3
High (5-7 visits)	43	33.6
Extensive (8-20 visits)	12	9.4
Participation in Other Programs		
Participated in EE programs other than TSS		
Yes	60	47.6
No	66	52.4

[a] Percentages are out of the 128 survey respondents and exclude the missing values (there were no more than 6 nonresponses for any given variable).

Shea, there are "repeat customers" to TSS's teacher workshops (personal communication, October 28, 1997). Also, many of the schools that are located in Jackson Hole, Wyoming send their fifth- and seventh-grade students to TSS and have TSS outreach programs done in their schools; therefore, these teachers were

participating in both residential education programs and outreach programs during one year. Twenty-seven percent of the teachers reported only visiting TSS once (low involvement), and 27% reported visiting only 2-4 times (medium involvement). These percentages probably represent teachers who participated in only one teacher workshop or had the outreach department visit their school only a small number of times.

Forty-eight percent of the survey respondents reported participating in programs other than TSS. Many of these programs were conducted at centers similar to TSS, including Keystone Science School, Aspen Center for EE, and the Yellowstone Institute. Other programs listed included *Project Wet, Project Wild*, and *Project Learning Tree*, and workshops offered through universities and state and federal natural resource agencies.

Independent Variables and Data Analysis for Testing Research Questions

In this chapter, the study hypotheses were analyzed using the data obtained in the survey. Figure 2 outlines the independent and dependent variables that will be used to test the study hypotheses. The independent variables are based on TSS program participation. Survey recipients were asked how many times they had participated in certain programs offered by TSS during the last five years (see question 15 in the survey in Appendix A). The programs listed on the survey were "residential education programs," "outreach programs," "teacher workshops," and a category labeled "other" was included. Because the survey recipients were not a random sample of teachers or

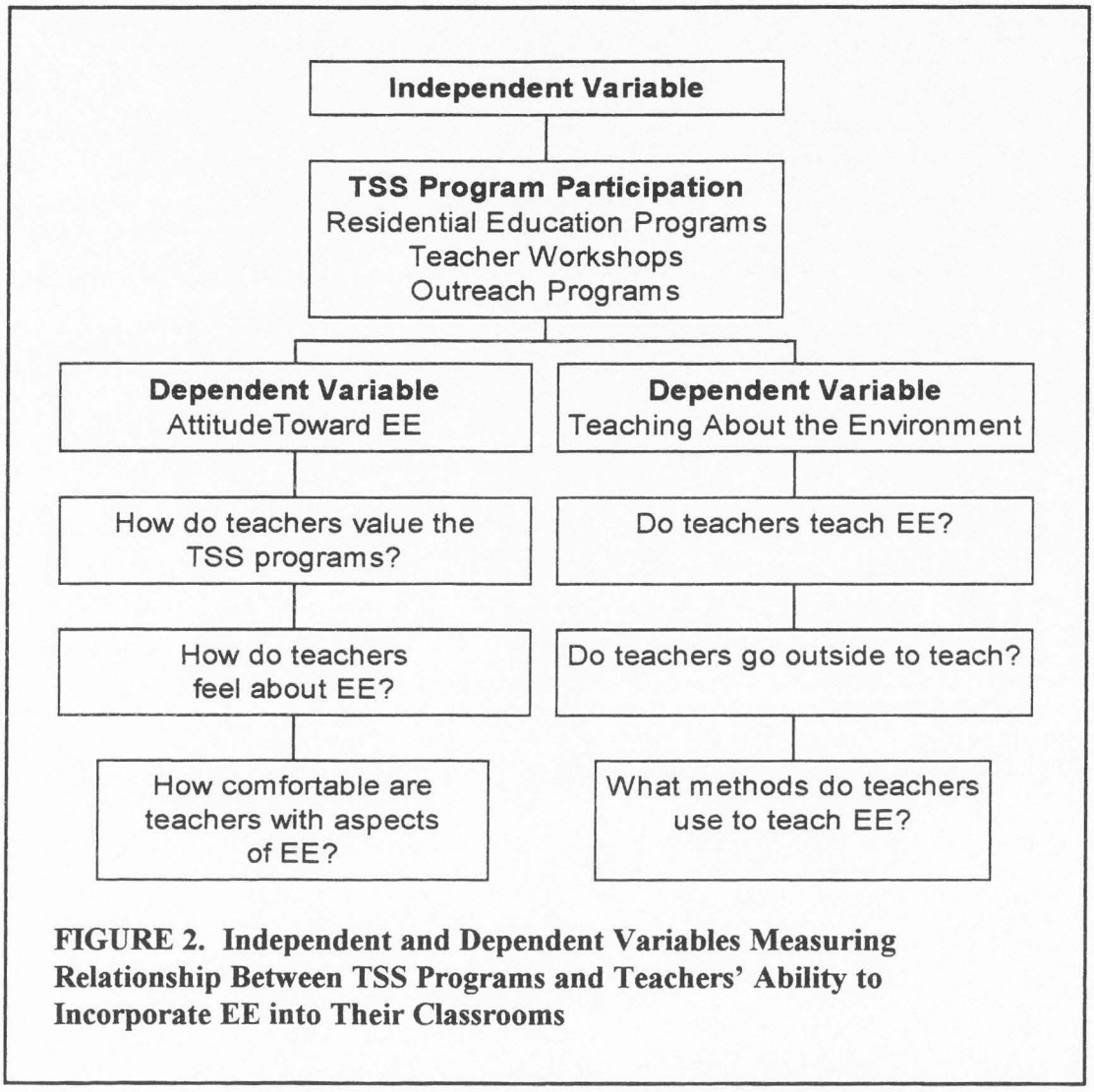

FIGURE 2. Independent and Dependent Variables Measuring Relationship Between TSS Programs and Teachers' Ability to Incorporate EE into Their Classrooms

TSS participants, descriptive statistics were used to create the independent variable.

Two specific participation variables were created to test the research questions. An independent variable was created that reported the percentage of the survey respondents who had participated in each of the three types of TSS programs. This variable includes the teachers who participated in more than one type of TSS program. In order to study the relationship between each of the three programs independently of

the other programs and the survey respondents' attitude toward and use of EE in the classroom, a second participation variable was created that divided the respondents into the following groups: *those that participated in residential education programs only* (n=22); *outreach only* (n=19); *and teacher workshops only* (n=36). Kruskal-Wallis one-way analysis of variance was used to test for relationships across the three types of TSS programs and is reported in Tables 8, 9, 11, and 12 (shown later). The Kruskall-Wallis one-way analysis of variance is based upon the H statistic, which is a rank sum measure that compares entire distributions rather than means, as with parametric analysis of variance (Lee & Maykovich, 1995). This nonparametric analysis of variance test is appropriate because there are several skewed dependent variables. Since the entire population of teachers was sampled, the Kruskall-Wallis statistic is used as an interpretive aid only and little emphasis is placed on statistical probability of the results.

The dependent variables were determined by questioning the teachers extensively about their attitude toward EE and the amount and type of EE done in their classrooms. They were also asked questions about the EE teaching methods they utilize, perceived barriers to EE, and where they teach about the environment.

The following chapter is the analysis of the three research questions. Question One looks at the three different TSS programs and the relationship between each program and the dependent variables. The three TSS programs are compared to determine which is the most useful to teachers for adapting EE into their teaching. Question Two examines the program components and their value in helping to adapt EE into the teachers' classrooms and provides a univariate ranking of components of the

three different TSS programs. Question Three explores the residential education programs independently of the other TSS programs and other life experiences utilizing two logistic regression models. The available survey data provide several useful "life experience" variables for looking at first-order relationships by contrasting the relationship of residential education programs and the amount of EE done. Initially, crosstabulations were used to examine percentages of teachers who reported taking their students outside "once a month or more" within categories of the life experience variables, controlling for participation in TSS residential education programs. To further consider these multivariate relationships, two logistic regression models were created, one for teachers who have participated in residential education programs, and another for teachers who have not.

CHAPTER 5

ANALYSIS OF RESEARCH QUESTIONS

In this chapter, the analysis will proceed in three sections. Each section of the analysis will pertain to one of the three research questions. The primary research question and hypothesis will be explored in the last section of this chapter. The first section will apply to the second research question.

Question One: Which of the Three Types of TSS Programs Do Teachers Find the Most Useful for Adapting EE into Their Classrooms?

Question one will be assessed by examining the attitudinal and behavioral dependent variables and comparing the responses of the teachers who participated in the three TSS programs. The first attitudinal variable to be considered is how teachers value the three types of TSS programs. The survey asked teachers to indicate how valuable each type of TSS program they have participated in was for adapting teaching about the environment into their classrooms (Table 7). The mean for residential education programs (3.78) was slightly higher than those for outreach education programs (3.47) and teacher workshops (3.49). More notable perhaps is the percentage of teachers who ranked residential education programs as "very valuable" (82.9%) for adapting teaching about the environment compared to the other two types of programs.

Also of note is the fact that all of the six survey respondents who had participated in both residential education programs and teacher workshops rated residential education

TABLE 7. Respondents' Indication of How Valuable Each Type of TSS Program Was for Adapting Teaching About the Environment into the Classroom [a]

Category	n	Mean	Standard deviation	% Very Valuable [b]
Residential education programs	41	3.78	.52	82.9
Outreach education programs	53	3.47	.72	58.5
Teacher workshops	69	3.49	.61	55.1

[a] Value questions are based on a 5-point Likert-type scale. 1 represents a negative response (not at all valuable) and 4 a positive response (very valuable).
[b] Percentages exclude the respondents that did not participate in a particular type of TSS program.

programs as "very valuable" while only two of these teachers rated teacher workshops as "very valuable" (the importance of the residential education programs will be further explored in the third section of this chapter).

The remainder of this section (Tables 8-12) will explore the groups of teachers who have participated in only one type of TSS program (second independent variable). This will enable a consideration of how helpful each program was for teachers independently of the other programs.

Table 8 illustrates the teachers' attitudes toward EE. In general, the teachers had a positive attitude toward EE. The mean response of all of the participants for the statement *"Teachers have a responsibility to teach about the environment"* is 4.2 (based on a 5-point scale, with 5 representing *strongly agree)*. This is not surprising because these teachers voluntarily attended these programs, and probably would not have chosen to participate in these types of programs if they did not feel EE was the

TABLE 8. Respondents' Attitudes Toward Environmental Education by Program [a]

	Residential Education (n=20)	Outreach Program (n=19)	Teacher Workshop (n=35)	Kruskal-Wallis H-Statistic
Teachers have a responsibility to teach about the environment				
Mean	4.25	4.05	4.26	
Standard Deviation	1.12	1.03	1.20	
% Agree or Strongly Agree [b]	85.0%	84.2%	88.5%	
				1.59
EE can be integrated into many subject areas				
Mean	4.20	3.68	4.26	
Standard Deviation	1.11	1.00	1.15	
% Agree or Strongly Agree [b]	85.0%	52.6%	85.7%	
				5.99 [c]
EE can be integrated only in science				
Mean	1.65	2.11	1.66	
Standard Deviation	1.14	1.15	1.28	
% Agree or Strongly Agree [b]	10.0%	15.8%	11.4%	
				5.76

[a] Attitude questions are based on a 5-point Likert-type scale. 1 represents a negative response (strongly disagree) and 5 a positive response (strongly agree).

[b] Percentages exclude the missing values (there were no more than 3 non-responses for any given variable).

[c] At least one category is statistically significantly different ($p \leq .05$).

responsibility of teachers. In general, the teachers were also in agreement that EE can be integrated into many subject areas, not just science. The means for the three types of program participants were very close, with those for residential education and teacher workshop participants showing a slightly more positive attitude toward EE. The outreach program participants reported having the least positive attitude toward EE, suggesting that there is a relationship between spending time *at* TSS and attitude

towards EE (Table 8). This will be further explored when the components of the three types of TSS programs are considered.

Table 9 reports how comfortable the teachers were with various aspects of EE . (Again, the table reports participation by individual program only allowing a comparison between TSS programs.) Although the means reveal that the teacher workshop participants reported being more comfortable with their *knowledge of natural processes*, *the scientific method*, and *environmental issues*, and *assigning group projects* and *teaching from case studies*, they were less comfortable with the other teaching methods than residential education program participants. Most notable is the difference in comfort levels in *role-playing with students*; 42% of residential education program participants and 31.6% of outreach program participants reported being "very comfortable" with this component while only 5.7% of teacher workshop participants did. *Role-playing* is one EE teaching method that is often utilized in TSS residential and outreach programs. Other methods frequently utilized during TSS residential education programs include *conducting research projects*, *teaching outdoors*, *playing games*, and doing *conflict resolution exercises*. In general, residential education participants reported being more comfortable with these teaching methods than the other program participants. The outreach program participants generally reported being least comfortable with all of the teaching aspects.

The second research question can be further explored by looking at three behavioral variables: do the teachers teach EE?; do the teachers take their students outside?; and, what EE teaching methods do the teachers use? Again, comparisons are

TABLE 9. Respondents' Comfort Level with Aspects of Environmental Education by Program Participation [a]

	Residential Education (n = 19)	Outreach Program (n = 18)	Teacher Workshop (n = 34)	Kruskal-Wallis H-Statistic
Your knowledge of natural processes				
Mean	2.26	2.61	1.76	
Standard Deviation	.93	1.04	.82	
% Very Comfortable	26.3%	21.1%	47.1%	
				9.25 [b]
Your knowledge of the scientific method				
Mean	1.95	2.50	1.65	
Standard Deviation	1.03	1.04	.95	
% Very Comfortable	47.4%	21.1%	62.9%	
				8.16 [b]
Your knowledge of environmental issues				
Mean	2.26	2.56	1.94	
Standard Deviation	.87	.92	.74	
% Very Comfortable	21.1%	15.8%	31.4%	
				6.19 [b]
Role-playing with your students				
Mean	2.05	2.61	3.06	
Standard Deviation	1.22	1.38	1.07	
% Very Comfortable	42.1%	31.6%	5.7%	
				8.38 [b]
Assigning research projects				
Mean	2.00	2.56	2.26	
Standard Deviation	1.15	1.25	1.16	
% Very Comfortable	47.4%	21.1%	31.4%	
				2.13

(Table 9 continued on next page)

[a] Questions are based on a 5-point Likert-type scale. 1 represents a positive response (very comfortable) and 5 a negative response (very uncomfortable).

[b] At least one category is statistically significantly different based on Kruskal-Wallis one-way analysis of variance ($p \leq .05$).

TABLE 9. (Continued) [a]

	Residential Education (n = 19)	Outreach Program (n = 18)	Teacher Workshop (n = 34)	Kruskal-Wallis H-Statistic
Taking students outside				
Mean	1.95	2.22	2.15	
Standard Deviation	1.03	1.40	1.21	
% Very Comfortable	42.1%	36.8%	37.1%	
				0.25
Assigning group projects				
Mean	2.11	2.50	1.85	
Standard Deviation	1.24	1.29	.78	
% Very Comfortable	42.1%	26.3%	37.1%	
				2.72
Teaching from case studies				
Mean	2.95	3.22	2.71	
Standard Deviation	1.22	.94	1.06	
% Very Comfortable	21.1%	5.6%	17.1%	
				2.95
Using games for teaching				
Mean	1.89	2.56	2.56	
Standard Deviation	1.20	1.34	1.05	
% Very Comfortable	52.6%	27.8%	14.3%	
				5.39
Assigning conflict resolution exercises				
Mean	2.58	2.83	2.76	
Standard Deviation	1.02	1.25	.96	
% Very Comfortable	21.1%	22.2%	11.4%	
				0.61

[a] Questions are based on a 5-point Likert-type scale. 1 represents a positive response (very comfortable) and 5 a negative response (very uncomfortable).

[b] At least one category is statistically significantly different based on Kruskal-Wallis one-way analysis of variance ($p \leq .05$).

made among teachers who have participated in only one of the three types of TSS programs.

Table 10 illustrates how much EE is taught by the program participant teachers. A higher percentage of teacher workshop participants reported teaching about the environment "often" compared to the other two program participants. One reason for this may be that teachers who bring their students to TSS or have TSS visit them in their classrooms do less teaching about the environment because their students are already receiving this type of instruction from TSS. It is important to note that the majority of survey respondents reported teaching about the environment "sometimes" or "often" while only 3.9% reported "never" teaching about the environment.

Table 11 shows the amount of teaching about the environment and subjects other than EE done outside by the program participants. Participants of the residential education programs reported taking their students outside more often than the other two types of programs; 15% of the residential education teachers reported taking their students outside "more than once a week" to teach about the environment. More

TABLE 10. Amount of Environmental Education Done by TSS Program

	Residential Education		Outreach Program		Teacher Workshop		All	
	n	%	n	%	n	%	n	%
Often	6	28.6	5	26.3	19	52.8	30	39.5
Sometimes	11	52.4	11	57.9	12	33.3	34	44.7
Rarely	2	9.5	3	15.8	4	11.1	9	11.8
Never	2	9.5	--	--	1	2.8	3	3.9
Total	21	100.0	19	100.0	36	100.0	76	100.0

TABLE 11. Amount of Teaching Done Outside by Program Participation [a] [b]

	Residential Education (n = 20)	Outreach Program (n = 19)	Teacher Workshop (n = 34)	Kruskal-Wallis H-Statistic
Take students outside to teach EE?				
Mean	3.90	4.21	4.06	
Standard Deviation	1.29	.63	1.42	
% Never	5.0%	0.0%	17.1%	
% Once A Week or More	15.0%	0.0%	8.6%	
				0.39
Take students outside to teach other subjects?				
Mean	3.85	4.47	4.41	
Standard Deviation	1.46	.70	1.23	
% Never	10.0%	10.5%	23.5%	
% Once A Week or More	20.0%	0.0%	2.9%	
				1.90

[a] Questions are based on a 6-point Likert-type scale; 1 represents more than once a week, 2 represents once a week, 3 represents once or twice a month, 4 represents once or twice a term, 5 represents once or twice a year, and 6 represents never.

[b] For both variables, none of the categories were statistically significantly different based on Kruskal-Wallis one-way analysis of variance.

notable is the relatively high percentage of teacher workshop participants who reported "never" taking their students outside to teach about the environment (17.1%) and subjects other than EE (23.5).

Table 12 shows which EE teaching methods were being used by teachers who have only participated in one of the three types of TSS programs. In general, there is virtually no difference in the use of these methods by the three types of program participants either statistically or practically, but there are some interesting results to note. Only the use of *individual projects* was found to be statistically significantly

TABLE 12. Respondents' Use of Environmental Education Teaching Methods by Program Participation [a]

	Residential Education (n=14)	Outreach Program (n=15)	Teacher Workshop (n=28)	Kruskal-Wallis H-Statistic
Role-playing				
Mean	2.16	2.33	2.00	
% Use 4 times or more	21.1%	33.3%	27.3%	
% Never Use	15.8%	11.1%	42.4%	
				2.28
Audiovisuals				
Mean	3.11	3.11	3.37	
% Use 4 times or more	66.7%	77.8%	74.3%	
% Never Use	5.6%	--	--	
				1.87
Lectures				
Mean	3.11	3.11	3.29	
% Use 4 times or more	61.1%	57.9%	71.4%	
% Never Use	5.6%	5.3%	2.9%	
				0.52
Research projects/experiments				
Mean	2.47	2.72	2.91	
% Use 4 times or more	42.1%	55.6%	54.3%	
% Never Use	21.1%	5.6%	8.6%	
				3.53
Guest Speakers				
Mean	1.95	2.26	1.89	
% Use 4 times or more	21.1%	31.6%	25.7%	
% Never Use	26.3%	5.3%	37.1%	
				2.67
Journals				
Mean	2.28	2.47	2.17	
% Use 4 times or more	27.8%	29.5%	37.2%	
% Never Use	22.2%	5.9%	42.9%	
				1.32
Field Trips				
Mean	2.32	2.17	2.37	
% Use 4 times or more	36.9%	16.7%	42.9%	
% Never Use	10.5%	--	20.0%	
				1.95

(Table 12 continued on next page)

[a] Teaching Methods questions are based on a 5-point Likert-type scale; 1 = never, 2 = 1-3 times, 3 = 4-10 times, 4 = 11-20 times, and 5 = 20 or more times per year.

TABLE 12. (Continued)

	Residential Education (n=14)	Outreach Program (n=15)	Teacher Workshop (n=28)	Kruskal-Wallis H-Statistic
Individual Projects				
Mean	2.28	2.06	2.40	
% Use 4 times or more	33.4%	16.7%	42.9%	
% Never Use	11.1%	16.7%	8.6%	
				6.07[b]
Group Projects				
Mean	2.28	2.28	2.60	
% Use 4 times or more	33.4%	22.3%	45.8%	
% Never Use	11.1%	--	5.7%	
				4.13
Observations				
Mean	2.41	2.53	2.85	
% Use 4 times or more	41.2%	52.6%	58.8%	
% Never Use	5.9%	--	8.8%	
				2.05
Case Studies				
Mean	1.53	1.65	1.68	
% Use 4 times or more	5.9%	5.9%	14.7%	
% Never Use	52.9%	41.2%	52.9%	
				1.12
Games				
Mean	2.28	2.11	2.11	
% Use 4 times or more	33.3%	22.2%	40.0%	
% Never Use	27.8%	11.1%	34.3%	
				0.30
Conflict Resolution Exercises				
Mean	1.94	2.05	1.80	
% Use 4 times or more	11.1%	15.8%	14.4%	
% Never Use	16.7%	15.8%	42.9%	
				0.77
Environmental Issues Investigations				
Mean	2.11	1.83	2.17	
% Use 4 times or more	22.3%	11.1%	28.6%	
% Never Use	22.2%	27.8%	25.7%	
				2.82
Supplemental Curricula				
Mean	2.27	2.47	2.47	
% Use 4 times or more	46.7%	35.3%	46.7%	
% Never Use	40.0%	11.8%	26.7%	
				0.75

[b] At least one category is statistically significantly different based on Kruskal-Wallis one-way analysis of variance ($p \leq .05$).

different based on Kruskal-Wallis one way analysis of variance. A greater percentage of the teacher workshop participants reported using *individual projects* "four or more times per year" followed by residential education program participants and then outreach program participants. Also of note is the difference between comfort level and actual use of some of the teaching methods (comparing results from Tables 9 and 11). A greater percentage of residential education program participants reported being comfortable with *role-playing with students*, *assigning research projects*, and *assigning conflict resolution exercises*, but they did *not* report using these methods more often than the other two types of program participants. This inconsistency between attitude (comfort level) and behavior was also found in the literature (Ham & Sewing, 1987).

In the case of *role-playing* among the teacher workshop participants, there is a parallel between their attitude and their behavior. Only 5.7% of these teachers reported being "very comfortable" with role plays and 42.4% reported "never" using this method to teach about the environment. Another method of interest is the use of *journals* to teach about the environment. Journals are used in all of the residential education and outreach programs at TSS for a majority of the program lessons while they may only be introduced as a method in the teacher workshops. Although 37.3% of the teacher workshop participants reported using journals "four or more times per year," 42.9% reported "never" using journals.

In general, it appears that the teacher workshop participants are more comfortable with EE teaching methods, teach about the environment more, and have a better attitude toward EE. Residential education participants do best with taking their

students outside. Overall, there is not much difference statistically in the three types of TSS program participants and their use of EE in the classroom. More important is the fact that only 15.7% of all of the survey participants reported doing little or no EE. Based on these results, none of the three types of TSS programs can be labeled as the *one most useful program* for adapting EE into the classroom, but, in general, all three types of program participants rated the programs highly. However, the results seem to imply that, in general, the outreach programs rated lower with the participant teachers, and the residential education programs and teacher workshops rated about the same.

Question Two: Which Components of the Three Types of TSS Programs Do Teachers Find the Most Useful for Adapting EE into Their Classrooms?

The following section explores the third research question, which asks, "*Which components of the three types of TSS programs do teachers find the most useful for adapting EE into their classrooms?*" The teachers were asked to indicate how valuable certain components of TSS programs were for adapting teaching about the environment into their classrooms. In this section, the tables and graphs report the responses of all of the teachers who participated in the three programs, not just teachers who participated in one type of TSS program. All three component graphs demonstrate that, in general, the survey respondents find these components useful for adapting teaching about the environment into their classrooms. The range of means was 3.72 for *observing TSS staff teach in a TSS classroom* to 4.48 for *spending time outdoors at TSS* on a scale ranging from 1 (meaning *no importance)* to 5 (meaning *very important)*. This speaks well of the

TSS programs, but it is also a reflection of the survey participants. The participants are a nonrandom sample of teachers, the majority of which teach about the environment in their classrooms. Given this, the programs rated highly overall.

Figure 3 and Table 13 illustrate the means and percentage distributions comparing components of TSS residential education programs. The modal response for four out of five of the components was "very important." Notably, 67.4% of the teachers found *spending time outdoors* "very important" and 55.8% of the teachers found *observing TSS staff teach outdoors at TSS* "very important."

Figure 4 and Table 14 illustrate the means and percentage distributions comparing components of TSS outreach programs. The modal response for all four of these components is 4, but *application of scientific method* and *observing a role play in your classroom* stand out as components that were rated very highly.

Figure 5 and Table 15 illustrate the means and percentage distributions comparing components of TSS teacher workshops. The modal response for four out of the five components is 5. *Spending time outdoors* rated as the highest component for any of the three programs with 68.7% of the teachers rating it as "very important" for adapting teaching about the environment into their classrooms. The same component rated "very important" with 67.4% of the residential education participants.

The teachers were next asked to write in other components of all three types of TSS programs they identified as valuable in their teaching. The most common components written in included: gaining personal knowledge about the environment and gaining a better appreciation of the natural world; obtaining ideas for adapting hands-on

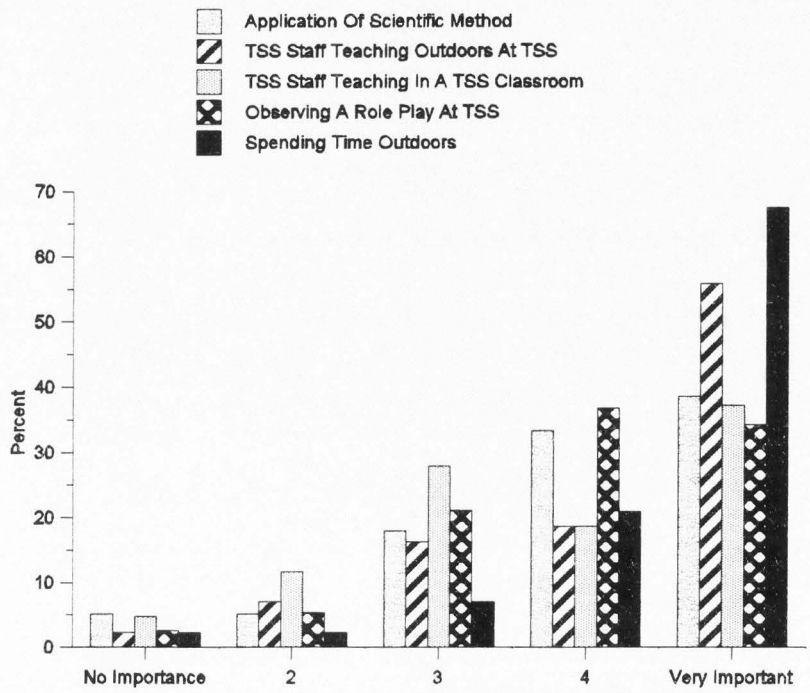

FIGURE 3. Percentage Distributions Comparing Teachers' Reported Value of TSS Residential Education Program Components

TABLE 13. Descriptive Statistics For Teachers' Reported Value of TSS Residential Education Program Components [a]

Category	n	Mean	Standard deviation	% Very Important [b]
Application of scientific method	39	3.95	1.12	38.5
Observing TSS staff teach outdoors at TSS	43	4.19	1.10	55.8
Observing TSS staff teach in a TSS classroom	43	3.72	1.22	37.2
Observing a role play at TSS	38	3.95	1.01	34.2
Spending time outdoors at TSS	43	4.49	.91	67.4

[a] Value questions are based on a 5-point Likert-type scale; 1 represents a negative response (no importance) and 5 a positive response (very important).

[b] Percentages exclude missing values.

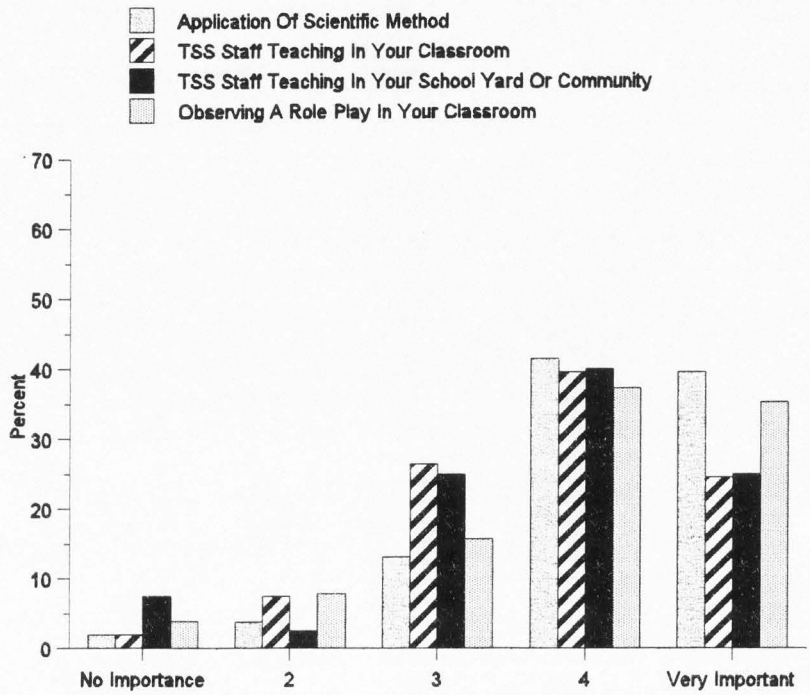

FIGURE 4. Percentage Distributions Comparing Teachers' Reported Value of TSS Outreach Program Components

TABLE 14. Descriptive Statistics For Teachers' Reported Value of TSS Outreach Program Components [a]

Category	n	Mean	Standard deviation	% Very Important [b]
Application of scientific method	53	4.13	.92	39.6
Observing TSS staff teach in your classroom	53	3.77	.97	24.5
Observing TSS staff teach in your school yard or community	40	3.73	1.11	25.0
Observing a role play in your classroom	51	3.92	1.09	35.3

[a] Value questions are based on a 5-point Likert-type scale; 1 represents a negative response (no importance) and 5 a positive response (very important).

[b] Percentages exclude missing values.

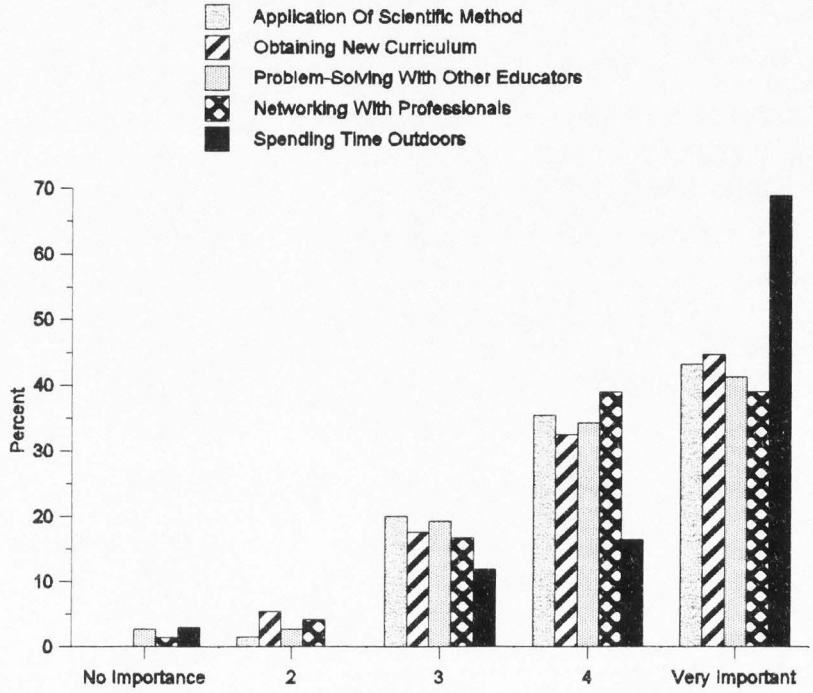

FIGURE 5. Percentage Distributions Comparing Teachers' Reported Value of TSS Teacher Workshop Components

TABLE 15. Descriptive Statistics For Teachers' Reported Value of TSS Teacher Workshop Components [a]

Category	n	Mean	Standard deviation	% Very Important [b]
Application of scientific method	65	4.20	.81	43.1
Obtaining new curriculum	74	4.16	.91	44.6
Problem-solving with other educators	73	4.08	.98	44.1
Networking with professionals	72	4.10	.92	38.9
Spending time outdoors at TSS	67	4.48	.93	68.7

[a] Value questions are based on a 5-point Likert-type scale; 1 represents a negative response (no importance) and 5 a positive response (very important).

[b] Percentages exclude missing values.

approaches to learning; learning how to integrate art and science; inspiring teachers to start natural resource or ecology clubs at their own schools; and promoting an awareness and appreciation for the natural world in their students. Only the last of these components can be considered unique to one or two types of TSS programs (in this case, residential education or outreach programs), but there were components written in as valuable that are *only* found in the residential education programs at TSS. There were no components written in response to this question that are found *only* in teacher workshops or outreach programs.

Components unique to the residential education programs that were written in included: finding ideas for EE reference materials; learning directly with their students in the field; observing the behind-the-scenes logistical details (kitchen duties, equipment management, etc.) that is part of an outdoor, environmental program; and providing both teachers and students with the opportunity to learn to be more responsible for themselves in a field setting. More specifically, one teacher wrote about the "natural consequences" students experience if they leave their mittens or hats behind when they go in the field at TSS. A few teachers identified TSS and its residential education programs as an inspiration and resource in writing and funding their own EE curriculum. Other teachers explained how they integrate their TSS trip or experience into their year or semester-long classroom curriculum. Several teachers identified specific lessons and activities from TSS programs as being influential in their teaching. These included: conflict mediation role-plays; stream studies; and lab trays that utilize museum specimens of plants and animals to introduce a concept or topic such as migration.

A final component of all three TSS programs that was mentioned as being positive was the nonbiased approach TSS takes to studying issues. One teacher complimented TSS's methods of finding accurate information and, "imparting a real life balance (of real life workers in Western life) to the EE influences." Another teacher wrote:

> I'm very careful about material used with my students - due to the fact that parents are involved in careers/work related to the oil/gas industry. IN NO WAY will I ever allow anything to demean them or cause students at this age to question their parents' life. I have discussed this with instructors and administrators at TSS and shared this view. So far, in the three years I have attended the school, no breach has been made.

Teachers were also asked to identify the most *influential* components of experiences at centers other than TSS. Again, hands-on learning and gaining an appreciation for and knowledge of the environment were the most common responses. Other common responses included integrating art and science, creating curriculum appropriate for certain grades and core objectives, taking field trips, participating in the activities that the school children will do, obtaining field training, gaining information on environmental issues, networking with teachers and other professionals, observing EE personnel and learning new teaching techniques, recognizing their students' diverse abilities, and learning about resources, including resource managers, and EE materials.

In the first two sections of this chapter, it has been shown that the survey respondents reported that *all three* of the TSS programs are important to their own ability to teach about the environment in the classroom. It appears that each type of program benefits teachers in different ways. For the most part, the teacher workshop

participants reported being more comfortable with their own knowledge about EE, and they reported teaching EE more often than teachers who have participated in only one of the other two types of programs. Unique components to the teacher workshops that rated highly are *obtaining new curriculum*, *problem-solving with other educators*, and *networking with professionals*.

The residential education and outreach program participants reported being more comfortable with specific methods of EE, and they reported applying those methods more often than teacher workshop participants. Also, specific components unique to residential education programs that help teachers incorporate EE into their own classrooms are *observing TSS staff tech outdoors at TSS*, *observing TSS staff teach in a TSS classroom*, and *observing a role play at TSS*. Unique components of the outreach programs that were reported as helpful are *observing TSS staff teach in your classroom*, *observing TSS staff teach in your schoolyard or community*, and *observing a role play in your classroom*.

By looking at the two types of programs designed for school children, in general, there is an indication that the residential education programs are more likely to increase a teacher's ability to teach EE. The outreach program participants reported a less positive attitude toward EE, as well as being less comfortable than the residential education participants with all of the different aspects of EE. Outreach program teachers also reported going outside less often with their students, and, in general, the outreach program components did not rate as highly as the residential education program components. This probably has to do with the amount of time teachers actually spend at

these programs, as well as the opportunity for outreach teachers to not participate in the programs while they are occurring in their classrooms. As explained in Chapter 1, the residential education programs are longer in length than the outreach programs, and classroom teachers were often seen grading or doing other tasks during a TSS visit to their classroom. Also, the results seem to imply that the residential education programs are at least as important as teacher workshops for helping teachers teach about the environment. In the following section, residential education programs will be examined more closely.

Question Three: Is There a Relationship Between Residential Education Programs at TSS and Teachers' Ability to Teach About the Environment?

The final section of this chapter explores the primary research question, which asks, "*Is there a relationship between residential education programs at TSS and teachers' ability to teach about the environment?*" The first two sections of this chapter established that residential education programs are highly valued for adapting teaching about the environment into the classroom by teachers who participated in TSS programs in 1994, but are residential education programs unique? This is a difficult question to address, mainly because there are many different components of residential education programs that may be influential on teachers and many different ways that teachers may adapt such experiences into their own teaching. This section will explore these programs independently of the other TSS programs and other life experiences and use a behavioral

dependent variable in order to study the relationship between teachers' ability to teach about the environment and their experiences with the residential education programs.

Because all of the behavioral dependent variables were demonstrating skew towards teaching about the environment "often," a dummy variable was created that contrasts teachers that do the most EE with those who do less EE. The variable *going outside to teach about the environment* was chosen for this purpose and dichotomized into categories contrasting teachers who reported taking their students "outside often" ("once a month or more," n=52) with teachers who reported taking their students "outside less than often" ("less than once per month," n=72). "Once a month or more" was also a good dividing point because there are several EE activities, such as research projects and observing seasonal changes, that might not reasonably be done more than once per month.

Table 16 displays the proportion of teachers who reported taking their students "outside often" and "less than often" to teach EE based on participation in residential education programs. Fewer than half (41.9%) of all the teachers reported taking their students "outside often" ("once a month or more") regardless of whether they have participated in residential education programs. However, a greater percentage of those teachers who have participated in residential education programs take their students "outside often" (46.3%) compared to teachers who have not participated in residential education programs (39.8%). In looking at this, it appears that there is only a weak correlation between residential education participation and teaching outside often.

However, residential education participation may still have important indirect

TABLE 16. Number and Percent of Teachers Who Take Their Students Outside Often (Once a Month or More) to Teach About the Environment by Residential Education Program Participation

	Participate in residential education programs?					
	No		Yes		Total	
	n	%	n	%	n	%
Less than once a month	50	60.2	22	53.7	72	58.1
Once a month or more	33	39.8	19	46.3	52	41.9
Total	83	100.0	41	100.0	124	100.0

associations with amount of teaching about the environment done outside by classroom teachers and other important influences on teachers. The available survey data provide several useful "life experience" variables for looking at first-order relationships by contrasting the relationship of residential education programs and the amount of EE done, specifically going outside to teach EE. The "life experience" variables that might explain why teachers take their students outside to teach about the environment include: participation in other TSS programs; participation in programs at centers other than TSS; gender; completion of EE college courses; membership in environmental organizations; subjects taught by the teacher; and the number of years teaching. In terms of these variables, the third research question may now be rephrased as a null hypothesis:

> *The relationship between life experience variables and the amount of teaching about the environment done outside is independent of participation in residential education programs at TSS.*

In this hypothesis, participation in residential education programs becomes an intervening variable between other life experiences and teaching about the environment outside. If the relationships between these variables and amount of teaching done outside do not differ for teachers who have and have not participated in residential education programs, then it is unlikely that residential education has an important influence on teachers' own EE efforts.

Initially, crosstabulations were used to examine percentages of teachers who reported taking their students "outside often" within categories of the life experience variables, controlling for participation in TSS residential education programs. Table 17 summarizes these results for selected categories of life experience variables (see Appendix D for complete table summaries). To further consider these multivariate relationships, two logistic regression models were created (Table 18), one for teachers who have participated in residential programs, and another for teachers who have not (see Appendix E for complete analyses).

One of the most important observations to be made from Table 17 is that a greater percentage of teachers who have participated in residential education, in addition to at least one of the other TSS programs, were taking their students "outside often" (57.1%) compared to teachers who have only participated in the other two types of TSS programs (36.4%)—a difference of 21%. The opposite relationship is found with teachers who have participated in programs at other EE centers. However, it is difficult to determine why this is so without a knowledge of the characteristics of programs at these other centers.

TABLE 17. Number and Percent of Teachers Who Take Their Students Outside Often (Once a Month or More) to Teach About the Environment for Selected Categories of Life Experience Variables by Residential Education Participation [a]

Life Experience Variables	Participate in residential education programs?			
	No		Yes	
	n	%	n	%
EE Program Participation:				
Participated in other TSS programs	28	36.4%	12	57.1%
Participated in programs at other EE centers	24	57.1%	8	47.1%
Gender:				
Male	7	26.9%	8	50.0%
Female	25	45.5%	11	44.0%
College EE Courses:				
Have taken	27	46.6%	13	52.0%
Have not taken	5	22.7%	5	38.5%
Member of Environmental Organization:				
Yes	18	64.3%	4	44.4%
No	14	25.9%	15	48.4%
Subjects Taught:				
Science only	10	35.7%	3	42.9%
All subjects	21	43.8%	14	51.9%
Years Teaching:				
1-10 years	8	30.8%	4	30.8%
11-20 years	15	44.1%	9	52.9%
More than 20 years	10	43.5%	6	54.5%

[a] Complete tables can be found in Appendix D.

The relationship between the residential education programs and gender is interesting. In Table 17, about 46% of female teachers who have not participated in residential education programs reported taking their students "outside often" compared to about 27% of male teachers—a difference of 19%; but among teachers who have participated in residential education programs, 50% of males reported taking their

students "outside often" compared to 44% of female teachers—a difference of 6%, but in the opposite direction.

A similar difference exists among teachers who have and have not taken college-level EE courses. Among teachers who have not participated in residential education programs, a difference of 24% exists between the proportion who take their students "outside often" if they have taken college-level EE courses (46.6%) and those who have not taken college-level EE courses (22.7%). This difference decreases to 13% among teachers who have participated in residential education programs.

An even greater contrast exists between teachers who are members of environmental organizations and those who are not. Among teachers who have not participated in residential education programs, a difference of 38% exists between the proportion who take their students "outside often" if they are members of environmental organizations (64.3%) and those who are not members of environmental organizations (25.9%). In comparison, only a 4% difference exists among teachers who have participated in residential education programs.

Less substantial differences exist for subjects taught and teaching experience. An 8% difference exists between teachers who teach all subjects (44%) and teachers who teach science only (36%) for teachers who have not participated in residential education programs; the difference increases to 9% for teachers who have participated in residential education programs at TSS. There is no difference in the percentage of new teachers (1-10 years) who reported taking their students "outside often" among teachers who have and have not participated in residential education programs. A greater

percentage of teachers reported taking their students "outside often" if they had participated in residential education programs for teachers who had been teaching longer (9% for teachers who have been teaching 11-20 years and 11% for teachers who have been teaching >20 years).

As noted in the logistic regression models in Table 18, the foregoing observations can be further considered by examining conditional (or partial) odds ratios between the life experience variables and whether teachers take their students "outside often," again controlling for participation in residential education programs. Model 1 represents teachers who have not participated in residential education programs. In general, this model does a good job of correctly classifying how often teachers take their students outside (79.8% correctly classified). Model 2 does not classify the observations as well as Model 1 (60.5% of observations correctly classified). This is largely due to the generally smaller differences among teachers who have participated in residential education programs, in terms of the other life experience variables. This is an important finding that supports the observations made in Table 17. Teachers who do not have the other life experience characteristics that are related to higher likelihood of teaching EE outside are more similar to those who do if they have participated in residential education programs in regards to going "outside often" with their students.

Looking more specifically at the results in Table 18, five of the seven life experience variables in Model 1 have conditional odds ratios of 2 or higher, indicating that teachers who have these characteristics are at least twice as likely to take their students "outside often." In Model 2 (which represents teachers who have participated

TABLE 18. Conditional Odds Ratios from Logistic Regression Models Predicting Whether Teachers Take Their Students Outside Often to Teach About the Environment [a]

	Participated in residential education programs?	
	Model 1	Model 2
	No	Yes
	(n = 84)	(n = 44)
Dependent Variable:		
Teach Outside Often (0 = No, 1 = Yes)		
Conditional Odds Ratios for Independent Variables:		
Participated in other TSS programs (1 = Yes)	0.066	1.810
Participated in programs at other EE centers (1 = Yes)	3.503	0.861
Gender (1 = Female)	2.404	0.711
Taken college EE courses (1 = Yes)	2.117	1.670
Environmental organization membership (1 = Yes)	4.635	1.432
Teach all subjects (1 = Yes)	2.310	1.671
Teaching experience (indicator-variable coding)		
Experience 1 (0 = 1-10 years, 1 = 21+ years)	0.387	0.492
Experience 2 (0 = 11-20 years, 1 = 21+ years)	0.734	0.718
Percent of cases correctly classified by model		
Teach outside less than once a month	89.4%	60.0%
Teach outside once a month or more	65.6%	61.1%
Overall	79.8%	60.5%

[a] Complete statistical analyses can be found in Appendix E

in residential education programs), all of these five odds ratios are lower, indicating smaller (or in some cases opposite) differences among teachers who do and do not have these characteristics. These results are consistent with the relationships observed in Table 17.

Teachers who are members of environmental organizations are 4.6 times more likely to report taking their students "outside often" among teachers who have not

participated in residential education programs (Model 1). However, among teachers who have participated in residential education programs, the conditional odds ratio is much smaller, 1.4 (Model 2). Similar contrasts are observed for teachers who have and have not taken college-level EE courses and for those who teach all subjects versus teachers who specialize in one subject. For the gender variable, among teachers who have not participated in residential education programs, female teachers are 2.4 times more likely than males to report taking their students "outside often." An opposite, but much smaller, contrast exists among teachers who have participated in residential education programs; in Model 2, female teachers are 0.71 times less likely to report taking their students "outside often."

The analyses in Tables 17 and 18 reject the null hypothesis stated on page 72, and accept an alternative hypothesis that *the relationship between life experience variables and the amount of teaching about the environment done outside is not independent of participation in residential education programs at TSS.* The percentages and odds ratios, conditional on participation in residential education programs, indicate that in most cases, teachers who have participated in residential education programs are more likely to report taking their students "outside often" to teach about the environment. It is important to remember that the component *spending time outdoors at TSS* was rated as the most valuable for adapting teaching about the environment into the classroom by the survey respondents. The third analysis section revealed that this component may also have an impression on the behavior of the survey teachers. The implications of the findings are discussed in Chapter 6.

CHAPTER 6

SUMMARY AND CONCLUSIONS

In the literature review, it was established that, if through training and participation in EE programs, classroom teachers are exposed to positive EE experiences that provide benefits for them as well as their students, these experiences may play a role in maintaining their enthusiasm for EE and their teaching of EE. This research was an important first step in evaluating teacher training in EE at TSS by surveying 1994 teacher participants. Environmental education programs at Teton Science School have been shown to be valuable to the teachers who have participated in them. This research has also documented components of TSS programs that provide both personal and professional benefits to participating classroom teachers and provides a long-term evaluation of the relationship between TSS programs and classroom teachers. The next question is: *What are the implications of these findings?* This chapter will address this question through a summary of the findings, a discussion of the implications of the findings to TSS and similar centers, and recommendations for future research.

Summary of Results

The primary research questions of this research asked: *"What are the characteristics of TSS classroom teacher participants?"* and *"Is there a relationship between residential education programs at TSS and teachers' ability to teach about the environment?"* In observing teachers' experiences at TSS, it was hypothesized:

"Residential education programs at TSS, although designed for students, help teachers to incorporate EE into their own classrooms." Initial analyses focused this research question on the issue of the amount of EE done outside.

A summary of the characteristics of the survey respondents can be found in Tables 1-5. The majority of the respondents were female teachers who teach middle or elementary grades in public schools. This is not surprising, because there are more programs taught to elementary and middle school students at TSS than high school students, only a handful of private schools attend TSS, and the fact that the majority of the respondents were women reflects a national average of elementary and middle school teachers. According to Table 1, only 10% of the survey respondents had been teaching for 5 or fewer years, and for the most part, the participants were in the middle of their careers. This is not surprising for a number of reasons. According to a first-year elementary school teacher in Swan Valley, Idaho, new teachers are often overwhelmed with the responsibilities of teaching and are not always able to manage teacher workshops that require travel, arrange outreach programs, or manage a class field trip as extensive as a 3- to 5-day trip to TSS. Also, school administrators are less likely to grant permission to new teachers to take students on extended field trips (B. Fielder, personal communication, September 27, 1997). Additionally, new teachers might be less likely to have the time to complete and return a mail survey.

Almost 30% of the survey respondents reported teaching science, and another 59% reported teaching all subjects including science. There is a possible lack of response to the survey by nonscience teachers. This became evident after two phone

calls from nonscience teachers questioning their participation in the survey. One of the callers suggested a more appropriate survey respondent would be the grade level's science teacher, even though the science teacher had not attended TSS. There were probably other nonscience teachers who did not think it was appropriate for them to complete the survey, but who did not call to verify this.

In general, classroom teachers who participated in TSS programs reported doing a great deal of teaching about the environment with their students, and they had a positive attitude about EE. It is important to realize that the programs at TSS, for the most part, are voluntary, and the teachers who attend them probably already have an enthusiasm or interest in environmental education. If classroom teachers had strong objections to teaching about the environment, they probably would not choose to attend TSS on their own or with their students, nor would they invite TSS into their classroom.

Open-ended questions and comments revealed one reason that the survey teachers reported teaching more about the environment and had a positive attitude about EE is due to the positive experiences they had while attending one or more TSS programs. The teachers credited TSS programs for their value in helping them incorporate EE into their classrooms. Also, they reported using methods to teach about the environment that are utilized in TSS programs, including *taking students outside*, *role-playing*, and *using journals*. This suggests that observing or learning about these methods was valuable training for their own teaching about the environment.

This research also found a relationship between participation in residential education programs TSS and teachers' ability to teach about the environment. Of the

three types of TSS programs included in this study, residential education programs were rated the most valuable for adapting teaching about the environment into their own teaching. In fact, all of the six survey respondents who had participated in both residential education programs and teacher workshops rated residential education programs as "very valuable" while only two of these teachers rated teacher workshops as "very valuable."

One of the key differences between these two types of TSS programs reported by the survey respondents is gaining knowledge versus observing applied environmental education. A greater percentage of the teacher workshop participants reported being comfortable with *knowledge of natural processes*, *the scientific method*, and *environmental issues* while a greater percentage of the residential education participants reported being comfortable with actual EE teaching methods such as *role-playing*, *assigning research projects*, *taking their students outside*, *using games for teaching*, and *assigning conflict resolution exercises* (Table 5). Furthermore, residential education participants also reported taking their students outside more often than participants of the other two types of programs *and* the analysis revealed that, in general, teachers who have participated in residential education programs are more likely to take their students "outside often" to teach about the environment (Tables 11 and 17-18). This is a valuable finding because it has not been documented before, and it provides organizations such as TSS with the knowledge that teachers, as well as students, are benefitting from programs designed for schoolchildren. Also, this knowledge can help in designing programs to maximize the likelihood of teacher benefits without diluting the content for students.

Secondary research questions asked: "*Which of the three types of TSS programs do teachers find the most useful for adapting EE into their classrooms?*" and "*Which components specific to each of the three types of TSS programs do teachers find the most useful for adapting EE into their classrooms?*"

As far as which program is the most useful to teachers for adapting EE into their classrooms, there is no clear "winner." Outreach programs seemed lower in general and teacher workshops and residential education programs about the same, but what is important is the fact that all three rated highly and were reported as being useful to classroom teachers. A notable finding that is unique to the literature is that both TSS residential education programs and outreach programs, although specifically designed for students, are helpful for teachers' ability to incorporate EE into their classrooms, especially the residential education programs.

Further analysis revealed that specific components of all three types of TSS programs were rated very highly by classroom teachers for their ability to incorporate EE into their classrooms. Again, in general the teachers rated the components of the TSS programs highly. The two components that rated the highest are *spending time outdoors at TSS* and *observing TSS staff teach outdoors at TSS*, the latter a component of the residential education programs. In general, the components of the outreach programs did not rate as highly as the components of the other two types of programs. This is probably a reflection of the duration of these programs. The outreach programs were typically much shorter in length, and there was a greater opportunity for the classroom teachers not to participate in the programs, thus lessening the overall exposure to the

knowledge components and applied EE components that rated highly with the other program participants.

Results of this study seem to imply that the residential education programs, in general, rate higher in terms of value for adapting EE into the classroom than the outreach programs, and at least as valuable as teacher workshops despite the fact that these programs target students. Residential education programs at TSS are valuable to teachers, in part, because of the time spent outside and the time spent observing others teach, thus providing both personal and professional benefits. According to the results, these teachers report passing these benefits along to their students through environmental education.

Implications of Findings

Implications of these findings include the knowledge that TSS programs are highly valued by the teachers who attend them, and that these same teachers reported doing a great deal of EE in their classrooms. This is very important information from a marketing standpoint as well as for funding acquisition. As a nonprofit organization, providing high quality programming is vital to TSS. Through its mission, TSS plays an important role in teaching educators about the environment and providing innovative and effective teacher training through its graduate program and teacher workshops.

This research provides the added knowledge that teachers are benefitting from student-based programs in a way that might not have been previously recognized as valuable, and that residential education programs may be as valuable for teaching about

the environment as teacher workshops. Specifically, the findings of this research show that these student programs benefit classroom teachers, and can be advertised as providing professional development opportunities for educators, including: gaining personal knowledge about the environment and natural resource related issues; learning new ideas for curriculum design; learning new ways of integrating hands-on activities; and discovering both inspiration and resources for writing and funding classroom EE programs. Also, this research provides data that TSS can present in support of its high quality programming in an attempt to acquire funds for continuing these programs or creating new programs.

One objective of this research project was to utilize the results of the survey to recommend components of effective EE programs that will assist environmental educators in designing effective EE training for classroom teachers. This can be accomplished by looking at the components that rated highly with the survey respondents. To the extent possible, these components should be added to or continue to be incorporated into the residential education programs, outreach programs, and teacher workshops at TSS.

The teacher workshop participants reported being the most comfortable with their knowledge of different aspects of EE, but what could be considered a missing component to teacher workshops is the opportunity to observe EE programs being taught to schoolchildren, or applied EE. Again, this is an important component of the TSS graduate student program (PREE); therefore, it is a recognized method of training future environmental educators. Where appropriate, and possible, it should be

incorporated into teacher workshops. This is possible at TSS, especially with the teacher workshops that take place during the summer months. There are numerous programs that involve school-aged students that occur at TSS in the summer, and many of these programs utilize the same lessons and methods that are taught during the residential education school programs. The teacher workshop programs could be redesigned to include overlap with these other programs, allowing teachers to observe TSS educators teaching outside.

As for the residential education programs, including the visiting teachers in as much of the program as possible, especially the outdoor lessons, is important. In addition, teachers could be provided with additional training during their stay including ideas for pre- and post-visit lessons to be conducted in the teacher's classroom, schoolyard, or local environment. In order to increase the teachers' comfort level with various aspects and teaching methods of EE programs, it is also recommended that they be provided with information and instruction while at TSS. In other words, provide mini-workshops for the visiting teachers to help them gain the background knowledge necessary for teaching about the environment back in their schools and local outdoor areas.

Suggestions for the TSS outreach programs include spending more time outdoors and providing post-visit lesson plans that also include the background information the teachers would need to complete the lessons. Since the data were collected for the current research, TSS has implemented a new outreach program titled *Journeys*. According to the *Journeys* curriculum book, this program provides a sense-

of-place curriculum for teachers and students, and the program includes both instruction for teachers at TSS and help, through a newsletter and informal visits, in incorporating the lessons at the teachers' school site. In many cases, TSS instructors team teach with classroom teachers at their school site. This program seems to combine many of the valuable components of the three types of TSS programs identified in this study. The next logical step is to conduct an evaluative study of this new program.

And finally, the highly rated components of all three types of TSS programs should be incorporated into EE programs at *other* centers where appropriate. TSS has the opportunity to serve as a model organization for providing effective instruction in EE and to provide information to other science and outdoor centers in EE instruction. In short, the findings of this research suggest that classroom teachers should be encouraged to participate with their students in all aspects of EE programs, especially if the program includes spending time outdoors.

Recommendations for Future Research

This research was an important first step in providing a long-term evaluation of programs that include participation by classroom teachers. The most important implication for future research is the knowledge that student programs have teacher benefits at facilities like TSS. This finding is unique and was not found in the current literature. Although the findings are important and useful, especially to TSS, there is still a great deal that needs to be explored through broader and collaborative studies. First, in addition to TSS continuing to survey participants of both their established and new

programs, it is recommended that centers similar to TSS conduct long-term evaluations of their programs, specifically looking at comparisons of different programs and their components and the relationship between their programs and participating teachers' ability to adapt EE into their classrooms. The findings of this study cannot be generalized to other centers and programs. Second, it would be useful to randomly select a group of TSS participants who are teachers and conduct more in-depth interviews to determine their use and attitude of EE and the life experiences that might have influenced them.

Because *spending time outdoors* was identified as the most valuable component of TSS programs, it would be useful to look at other teacher workshops, including national programs such as *Project Wild* and local efforts offered through universities and nature centers, to determine if there is a relationship between teachers *spending time outdoors* at these programs and teaching about the environment in their own schools. Perhaps *spending time outdoors* and *observing EE being taught in an outdoor setting* are missing components of other teacher training programs, and would be accepted as integral components of these programs if, through additional research, they are found to be valuable to teachers. In general, this type of research should not be limited to organizations like TSS that exist in pristine outdoor environments, where much of the program is conducted in an outdoor setting. Spending time outdoors in the schoolyard or in local parks and natural areas might also prove to be valuable to teachers in adapting EE into their classrooms.

One final consideration is that the causality implications are based on

relationships; therefore, the results need to be replicated using experimental design. This research could not completely control for the elements of causality due to both time and financial limitations, and thus this research was concerned primarily with establishing a relationship. Also, teacher participants of TSS programs independently chose to participate in the programs, making random assignment to control and experimental groups impossible. In order to add to the confidence of causality, at least a quasi-experimental design needs to be conducted. In particular, it would be desirable to design a study that compares TSS participants with nonparticipants.

This research results in a better understanding of the relationship between existing TSS programs and classroom teachers' ability to teach about the environment. In order to improve the teaching of EE in the public and private school systems, it is critical to have an understanding of why teachers choose or do not choose to teach about the environment and how to help teachers incorporate EE into their own teaching. Without teachers who are willing and able to teach EE, very little instruction about the environment will occur in formal school settings.

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APPENDICES

Appendix A: The Survey Including the Informed Consent/Introductory Letter

November 18, 1996

Dear Participant:

The purpose of this survey is to study the effectiveness of teacher training in environmental education. Results of this research will be made available to educators involved in the design and implementation of teacher training efforts.

Your opinions and answers are *very important* to us. For our results to be representative of teachers who have participated in different environmental education programs, it is essential that each questionnaire be returned to us.

The questionnaire is divided into several sections, each of which is of equal importance. If you have no opinion for a question, just write **DK** (DON'T KNOW) in the margin and go on to the next question. If you wish to make additional comments or explain your answer, feel free to use any blank space, or you may include a separate letter with the completed questionnaire.

Your responses and comments will be confidential. An identification number has been placed on the back of the questionnaire for recording purposes only and individual names will not be associated with a completed survey or response. Therefore, please do not sign your name on the questionnaire. This information will be kept in a locked file cabinet in a locked room and only the Project Supervisor will have access. Once the project is completed, the data collected will be kept on file at Utah State University.

The survey will take approximately 20 minutes to complete and can be returned in the postage paid envelope provided. If you have any questions, please contact me at 801-797-3219. Thank you in advance for taking the time to complete this survey.

Sincerely,

Dale J. Blahna
Project Supervisor

Teacher Training in Environmental Education Project

Utah State UNIVERSITY

DEPARTMENT OF FOREST RESOURCES
College of Natural Resources
Utah State University
Logan, UT 84322-5215

Please give your opinion for all questions, answering them in the order that they appear without reading ahead. If you need more space to explain your answers, use any available space in or at the end of the questionnaire. If you have no opinion for a question, just *write* **DK** (DON'T KNOW) in the margin and go on to the next question.

Part I.

The following questions will tell us about your teaching experience.

1. Are you currently a classroom teacher? Please *circle* the correct response.

   1. YES
   2. NO ➜ If NO, you're done! Please mail your survey back to us anyway. It is important that we receive your response to verify our records. Thank You.

2. How many years have you been teaching in your current district? _____YEARS

3. In total, how many years have you been teaching? _____YEARS

4. What grade level do you teach?_____ Subject(s)?_____

_____

Part II.

For the purpose of this study, the following definition of *teaching about the environment*, or *environmental education*, will be used.

Environmental Education:

- concerns the interconnectedness between humans and the surrounding world;
- teaches about the natural processes which take place in the environment;
- recognizes that natural resources are essential for human activities, but at the same time are limited;
- is a process aimed at teaching students about environmental issues and the tools they need to solve and prevent environmental problems;
- can be taught both in formal and informal settings using a broad range of teaching and learning techniques;
- is concerned with building an environmental ethic.

5. Using the definition as a guide, do you currently teach about the environment in your classroom? Please *circle* the correct response.

1. YES - OFTEN
2. YES - SOMETIMES
3. YES - RARELY
4. NO ➜ If NO, please explain why in the space provided, and continue to Part IV on Page 6.

_____

_____

_____

6. Using a scale of 1 (STRONGLY DISAGREE) to 5 (STRONGLY AGREE), please *circle* the number that best indicates your opinion on the following statements.

	STRONGLY DISAGREE		NEUTRAL		STRONGLY AGREE
Classroom teachers have a responsibility to teach about the environment.	1	2	3	4	5

(continued on next page)

	STRONGLY DISAGREE		NEUTRAL		STRONGLY AGREE
I believe I can integrate environmental concepts and issues into **many** subject areas.	1	2	3	4	5
I believe that I can teach about the environment **only** while teaching science courses.	1	2	3	4	5

Part III.

This part of the survey asks questions about the amount and type of teaching about the environment done in your classroom.

For the next two questions, please *circle* the number corresponding to the appropriate response.

7. Approximately how often do you take your students outside/into the schoolyard to **teach about the environment**?

1. MORE THAN ONCE A WEEK
2. ONCE A WEEK
3. ONCE OR TWICE A MONTH
4. ONCE OR TWICE A TERM
5. ONCE OR TWICE A YEAR
6. NEVER

8. Approximately how often do you take your students outside/into the schoolyard to teach subjects **other than** environmental education?

1. MORE THAN ONCE A WEEK
2. ONCE A WEEK
3. ONCE OR TWICE A MONTH
4. ONCE OR TWICE A TERM
5. ONCE OR TWICE A YEAR
6. NEVER

9. If you take your students outside to teach about the environment or to teach subjects other than environmental education, please describe what types of activities/lessons you do with them.

_____

_____

_____

10. For each of the teaching methods listed below, please *circle* the response that best represents how often you use them to **teach about the environment**. We realize that overlap may exist in these methods, for example you might use role-playing to teach about conflict resolution. In these cases, circle the correct response for **both** methods.

	NUMBER OF TIMES PER YEAR				
Role-playing	**Never**	**1-3**	**4-10**	**11-20**	**>20**
Audiovisuals	**Never**	**1-3**	**4-10**	**11-20**	**>20**
Lectures	**Never**	**1-3**	**4-10**	**11-20**	**>20**
Research Projects/Experiments	**Never**	**1-3**	**4-10**	**11-20**	**>20**
Guest Speakers	**Never**	**1-3**	**4-10**	**11-20**	**>20**
Journals	**Never**	**1-3**	**4-10**	**11-20**	**>20**
Field Trips	**Never**	**1-3**	**4-10**	**11-20**	**>20**
Individual Projects	**Never**	**1-3**	**4-10**	**11-20**	**>20**
Group Projects	**Never**	**1-3**	**4-10**	**11-20**	**>20**
Observations (field trips, displays, objects)	**Never**	**1-3**	**4-10**	**11-20**	**>20**
Case Studies	**Never**	**1-3**	**4-10**	**11-20**	**>20**
Games	**Never**	**1-3**	**4-10**	**11-20**	**>20**
Conflict Resolution Exercises	**Never**	**1-3**	**4-10**	**11-20**	**>20**
Environmental Issues Investigations	**Never**	**1-3**	**4-10**	**11-20**	**>20**
Supplemental Curricula**	**Never**	**1-3**	**4-10**	**11-20**	**>20**

** Refer to question 11 below for examples of supplemental curricula that teach about the environment.

11. Please check which supplemental curricula you use, if any (be sure to list ones not provided):

*Audubon Adventure*____ *Project Wild*____ *Project Wet*____
*Project Learning Tree*____ *Aquatic Wild*____ *Nature Scope*____
*Keepers of the Earth*____ *Ranger Rick*____ *Pathways*____
*Tread Lightly*____
Others:

_____

_____

12. Using a scale of 1 (VERY COMFORTABLE) to 5 (VERY UNCOMFORTABLE), please *circle* the response which best indicates how comfortable you are with each of the following.

	VERY COMFORTABLE				VERY UNCOMFORTABLE
Your knowledge of natural processes.	1	2	3	4	5
Your knowledge of the scientific method.	1	2	3	4	5
Your knowledge of environmental *issues*.	1	2	3	4	5
Role-playing with your students.	1	2	3	4	5
Assigning research projects.	1	2	3	4	5
Taking students outside.	1	2	3	4	5
Assigning group projects.	1	2	3	4	5
Teaching from case studies.	1	2	3	4	5
Using games for teaching.	1	2	3	4	5
Assigning conflict resolution exercises.	1	2	3	4	5

13. Please *identify* any areas of **weakness** you have concerning your teaching about the environment.

_____

_____

_____

_____

Part IV.

This section of the survey asks you about your participation in Teton Science School and other environmental education center programs.

14. Have you participated in programs offered by the Teton Science School (TSS) or had TSS staff visit your classroom?

1. YES
2. NO ➜ If NO, please skip to question 20 on Page 8.

15. Please *indicate how many times* you have participated in each of the following programs offered by the Teton Science School **during the last five years**.

	Last Five Years
A. Residential Education Programs (attended overnight with schoolchildren)	_____ TIMES
B. Outreach Programs (Teton Science School staff visited your school)	_____ TIMES
C. Teacher Workshops	_____ TIMES
D. Other(s)	_____ TIMES

↪ Please describe other(s):

_____

_____

_____

16. Which of these three TSS programs have you participated in **most recently**?

1. RESIDENTIAL EDUCATION PROGRAM
2. OUTREACH PROGRAM
3. TEACHER WORKSHOP
4. I have not participated in these programs.

17. For each of the types of TSS programs, please indicate how valuable each program was for adapting teaching about the environment into your classroom.

	DID NOT PARTICIPATE	NOT AT ALL VALUABLE			VERY VALUABLE
RESIDENTIAL EDUCATION	NA	1	2	3	4
TEACHER WORKSHOPS	NA	1	2	3	4
OUTREACH PROGRAMS	NA	1	2	3	4

↪ If your answer was NOT AT ALL VALUABLE for any of the above, please explain:

RESIDENTIAL EDUCATION: _____

TEACHER WORKSHOPS: _____

OUTREACH PROGRAMS: _____

18. Using a scale of 1 (NO IMPORTANCE) to 5 (VERY IMPORTANT), please indicate how important the following components of **TSS** programs are to your ability to adapt teaching about the environment into your classroom. Please circle NA if the component was **not a part of the program you attended.**

	NO IMPORTANCE				VERY IMPORTANT	
Observing the application of the scientific method.	1	2	3	4	5	NA
Observing Teton Science School staff teach schoolchildren in an outdoor setting **at TSS**.	1	2	3	4	5	NA
Observing Teton Science School staff teach schoolchildren **in a TSS classroom**.	1	2	3	4	5	NA

(continued on next page)

	NO IMPORTANCE				VERY IMPORTANT	
Observing a role play with schoolchildren **at TSS**.	1	2	3	4	5	NA
Spending time outdoors **at TSS**.	1	2	3	4	5	NA
Observing Teton Science School staff **in your classroom**.	1	2	3	4	5	NA
Observing Teton Science School staff in an outdoor setting **at your school or in your community**.	1	2	3	4	5	NA
Observing a role play with students **in your classroom**.	1	2	3	4	5	NA
Obtaining new curriculum.	1	2	3	4	5	NA
Problem-solving with other educators.	1	2	3	4	5	NA
Networking with professionals.	1	2	3	4	5	NA

19. Are there **other** components of your TSS participation that have been influential in your ability to adapt teaching about the environment into your classroom? (Please describe)

_____

_____

_____

_____

20. Have you participated in programs offered at environmental education or science centers **other than** the Teton Science School?

1. YES
2. NO ➜ If NO, please skip to Part V on Page 9.

21. Please list the programs that you have participated in at centers **other than** the Teton Science School (TSS) **during the last five years**.

1. _____
2. _____
3. _____
4. _____
5. _____

22. Please identify the *most influential* components of the experiences listed above concerning your teaching about the environment.

_____
_____
_____

Part V.

Finally, we would like to learn a little about you. As with all other responses, your answers to these questions will remain *strictly confidential* and will be used for statistical analysis only.

For the following questions, please *circle* the appropriate response.

23. Please indicate which describes your school.

1. PUBLIC
2. PRIVATE

24. What is your gender? 1. FEMALE 2. MALE

25. What is your present age? _____ YEARS

26. Please list the college degree(s) you hold.

Degree	Field
_____	_____
_____	_____
_____	_____

27. Have you taken college courses relating to environmental education?

1. YES 2. NO

If YES, please describe:

_____
_____
_____

28. Are you a member of one or more clubs or organizations that try to educate members of the public on issues related to the environment?

1. YES 2. NO

If YES, which groups?

_____
_____
_____

Thank you for your participation! Please feel free to use any available space in this questionnaire or in a separate letter to provide any additional information you would like to share.

If you are willing to complete a phone interview as a follow-up to this survey, please provide the following:

Name:_____

Phone #:_____

Best Time(s) To Call:_____

This page will remain separate from the rest of the questionnaire to insure confidentiality of this survey. Thank You.

Appendix B: Reminder Postcard

November 27, 1996

Dear Participant:

As you may recall, I recently sent you a questionnaire regarding your experiences with different environmental education programs. The purpose of this research is to study the effectiveness of different teacher training programs. Results of the research will be useful to educators involved in the design and implementation of teacher training in environmental education.

Your responses are very important. For the results to be representative of teachers who have participated in different environmental education programs, it is essential that each questionnaire be returned to us.

If you have completed and returned the questionnaire, please accept my sincere thanks. If you have not, please do so at your earliest convenience. Thank You.

Sincerely,
Dale J. Blahna
Project Supervisor

Appendix C: Follow-Up Letter

January 3, 1997

Dear Participant:

As you may recall, I sent you a copy of a survey a week before Thanksgiving asking about your participation in various environmental education programs. The purpose of this survey is to study the effectiveness of teacher training in environmental education. Results of this research will be made available to educators involved in the design and implementation of teacher training efforts.

I am writing to you again because I have not received your completed survey, and your opinions and answers are *very important* to us. For our results to be representative of teachers who have participated in different environmental education programs, it is essential that each survey be returned to us. In the event that your survey has been misplaced, a replacement is enclosed.

As mentioned in my last letter, your responses and comments will be confidential. An identification number has been placed on the back of the survey for recording purposes only and individual names will not be associated with a completed survey or response. Therefore, please do not sign your name on the survey. This information will be kept in a locked file cabinet in a locked room and only the Project Supervisor will have access. Once the project is completed, the data collected will be kept on file at Utah State University.

The survey will take approximately 20 minutes to complete and can be returned in the postage paid envelope provided. If you have any questions, please contact me at 801-797-3219. Your cooperation is greatly appreciated.

Sincerely,

Dale J. Blahna
Project Supervisor

Appendix D: Complete Statistical Tables for Test of Independence of Life Experience Variables and Participation in Residential Education Programs on Amount of Teaching About the Environment Done Outdoors

Crosstab

		Res Ed											
		No						Yes					
		other TSS than Res Ed						other TSS than Res Ed					
		no		yes		Total		no		yes		Total	
		n	%	n	%	n	%	n	%	n	%	n	%
outside often to teach EE	Less than once a month	1	16.7%	49	63.6%	50	60.2%	13	65.0%	9	42.9%	22	53.7%
	Once a month or more	5	83.3%	28	36.4%	33	39.8%	7	35.0%	12	57.1%	19	46.3%
Total		6	100.0%	77	100.0%	83	100.0%	20	100.0%	21	100.0%	41	100.0%

Crosstab

		Res Ed											
		No						Yes					
		Participated in programs other than TSS?						Participated in programs other than TSS?					
		No		Yes		Total		No		Yes		Total	
		n	%	n	%	n	%	n	%	n	%	n	%
outside often to teach EE	Less than once a month	31	77.5%	18	42.9%	49	59.8%	13	54.2%	9	52.9%	22	53.7%
	Once a month or more	9	22.5%	24	57.1%	33	40.2%	11	45.8%	8	47.1%	19	46.3%
Total		40	100.0%	42	100.0%	82	100.0%	24	100.0%	17	100.0%	41	100.0%

Crosstab

		Res Ed											
		No						Yes					
		Gender						Gender					
		Male		Female		Total		Male		Female		Total	
		n	%	n	%	n	%	n	%	n	%	n	%
outside often to teach EE	Less than once a month	19	73.1%	30	54.5%	49	60.5%	8	50.0%	14	56.0%	22	53.7%
	Once a month or more	7	26.9%	25	45.5%	32	39.5%	8	50.0%	11	44.0%	19	46.3%
Total		26	100%	55	100%	81	100%	16	100%	25	100%	41	100%

Crosstab

		Res Ed											
		No						Yes					
		college courses related to EE?						college courses related to EE?					
		No		Yes		Total		No		Yes		Total	
		n	%	n	%	n	%	n	%	n	%	n	%
outside often to teach EE	Less than once a month	17	77.3%	31	53.4%	48	60.0%	8	61.5%	12	48.0%	20	52.6%
	Once a month or more	5	22.7%	27	46.6%	32	40.0%	5	38.5%	13	52.0%	18	47.4%
Total		22	100.0%	58	100.0%	80	100.0%	13	100.0%	25	100.0%	38	100.0%

Crosstab

		Res Ed											
		No						Yes					
		Member of organizations?						Member of organizations?					
		No		Yes		Total		No		Yes		Total	
		n	%	n	%	n	%	n	%	n	%	n	%
outside often to teach EE	Less than once a month	40	74.1%	10	35.7%	50	61.0%	16	51.6%	5	55.6%	21	52.5%
	Once a month or more	14	25.9%	18	64.3%	32	39.0%	15	48.4%	4	44.4%	19	47.5%
Total		54	100%	28	100%	82	100%	31	100%	9	100%	40	100%

outside often to teach EE * Subjects Taught * Res Ed Crosstabulation

Res Ed				Subjects Taught			
				All Subjects	Science	Other	Total
No	outside often to teach EE	Less than once a month	Count	27	18	5	50
			% within Subjects Taught	56.3%	64.3%	71.4%	60.2%
		Once a month or more	Count	21	10	2	33
			% within Subjects Taught	43.8%	35.7%	28.6%	39.8%
	Total		Count	48	28	7	83
			% within Subjects Taught	100.0%	100.0%	100.0%	100.0%
Yes	outside often to teach EE	Less than once a month	Count	13	4	5	22
			% within Subjects Taught	48.1%	57.1%	71.4%	53.7%
		Once a month or more	Count	14	3	2	19
			% within Subjects Taught	51.9%	42.9%	28.6%	46.3%
	Total		Count	27	7	7	41
			% within Subjects Taught	100.0%	100.0%	100.0%	100.0%

OUTSIDE outside often to teach EE * TEACH2 Teaching experience * RE Res Ed Crosstabulation

	RE Res Ed															
	No								Yes							
	Teaching experience								Teaching experience							
	1-10 years		11-20 years		>20		Total		1-10 years		11-20 years		>20		Total	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Less than once a month	18	69.2%	19	55.9%	13	56.5%	50	60.2%	9	69.2%	8	47.1%	5	45.5%	22	53.7%
Once a month or more	8	30.8%	15	44.1%	10	43.5%	33	39.8%	4	30.8%	9	52.9%	6	54.5%	19	46.3%
Total	26	100%	34	100%	23	100%	83	100%	13	100%	17	100%	11	100%	41	100%

Appendix E: Complete Statistical Analysis of Logistic Regression Models

LOGISTIC REGRESSION: OUTSIDE OFTEN TO TEACH EE FOR RES. ED. = 0 (NO)

Total number of cases: 128 (Unweighted)
Number of selected cases: 84
Number of unselected cases: 44

Number of selected cases: 84
Number rejected because of missing data: 5
Number of cases included in the analysis: 79

Dependent Variable Encoding:

Original Value	Internal Value
0	0
1	1

	Value	Freq	Parameter Coding (1)	(2)
TEACH2				
1-10 years	1	25	.667	-.333
11-20 years	2	32	-.333	.667
>20	3	22	-.333	-.333

Dependent Variable.. OUTSIDE outside often to teach EE

Beginning Block Number 0. Initial Log Likelihood Function

-2 Log Likelihood 106.65179

* Constant is included in the model.

Beginning Block Number 1. Method: Enter

Variable(s) Entered on Step Number
1.. OTHERTSS other TSS than Res Ed
V20 Participated in programs other than TSS?
V24 Gender
V27 college courses related to EE?
V28 Member of organizations?
SUBJECT2 Teach all subjects?
TEACH2 Teaching experience

Estimation terminated at iteration number 4 because
Log Likelihood decreased by less than .01 percent.

-2 Log Likelihood	77.252
Goodness of Fit	113.140
Cox & Snell - R^2	.311
Nagelkerke - R^2	.419

	Chi-Square	df	Significance
Model	29.399	8	.0003
Block	29.399	8	.0003
Step	29.399	8	.0003

Classification Table for OUTSIDE
The Cut Value is .50
Selected cases RE EQ 0

		Predicted: Less than once a (L)	Predicted: Once a month or (O)	Percent Correct
Observed				
Less than once a	L	42	5	89.36%
Once a month or	O	11	21	65.63%
			Overall	79.75%

Classification Table for OUTSIDE
The Cut Value is .50
Unselected cases RE NE 0

		Predicted: Less than once a (L)	Predicted: Once a month or (O)	Percent Correct
Observed				
Less than once a	L	8	12	40.00%
Once a month or	O	10	8	44.44%
			Overall	42.11%

* Some of the unselected cases are not classified due to missing values for the independent variables or categorical variables with values out of the range of the selected cases.

---------- Variables in the Equation ----------

Variable	B	S.E.	Wald	df	Sig	R	Exp(B)
OTHERTSS	-2.7263	1.6971	2.5807	1	.1082	-.0738	.0655
V20	1.2536	.5784	4.6977	1	.0302	.1590	3.5030
V24	.8772	.6581	1.7768	1	.1825	.0000	2.4042
V27	.7498	.7153	1.0987	1	.2945	.0000	2.1165
V28	1.5337	.6271	5.9811	1	.0145	.1932	4.6352
SUBJECT2	.8373	.6736	1.5451	1	.2139	.0000	2.3101
TEACH2			1.3658	2	.5051	.0000	
TEACH2(1)	-.9489	.8307	1.3047	1	.2534	.0000	.3872
TEACH2(2)	-.3087	.7046	.1920	1	.6613	.0000	.7344
Constant	-.6953	1.7266	.1622	1	.6872		

Correlation Matrix:

	Constant	OTHERTSS	V20	V24	V27	V28	SUBJECT2	TEACH2(1)	TEACH2(2)
Constant	1.00000	-.86373	-.15312	-.16712	-.19428	-.07182	-.03939	-.12121	-.00787
OTHERTSS	-.86373	1.00000	-.02051	-.10023	-.07136	-.06537	-.12032	.21757	.07501
V20	-.15312	-.02051	1.00000	-.03423	-.10859	-.05420	.13507	-.09271	-.01858
V24	-.16712	-.10023	-.03423	1.00000	.19974	-.03136	-.20602	-.20526	-.14375
V27	-.19428	-.07136	-.10859	.19974	1.00000	-.13339	-.27359	.16888	-.02071
V28	-.07182	-.06537	-.05420	-.03136	-.13339	1.00000	.29321	-.01116	-.06074
SUBJECT2	-.03939	-.12032	.13507	-.20602	-.27359	.29321	1.00000	-.30817	-.13717
TEACH2(1)	-.12121	.21757	-.09271	-.20526	.16888	-.01116	-.30817	1.00000	.56256
TEACH2(2)	-.00787	.07501	-.01858	-.14375	-.02071	-.06074	-.13717	.56256	1.00000

LOGISTIC REGRESSION: OUTSIDE OFTEN TO TEACH EE FOR RES. ED. = 1 (YES)

Total number of cases: 128 (Unweighted)
Number of selected cases: 44
Number of unselected cases: 84

Number of selected cases: 44
Number rejected because of missing data: 6
Number of cases included in the analysis: 38

Dependent Variable Encoding:

Original Value	Internal Value
0	0
1	1

	Value	Freq	Parameter Coding (1)	(2)
TEACH2				
1-10 years	1	11	.667	-.333
11-20 years	2	16	-.333	.667
>20	3	11	-.333	-.333

Dependent Variable.. OUTSIDE outside often to teach EE

Beginning Block Number 0. Initial Log Likelihood Function

-2 Log Likelihood 52.573874

* Constant is included in the model.

Beginning Block Number 1. Method: Enter

Variable(s) Entered on Step Number

1..	OTHERTSS	other TSS than Res Ed
	V20	Participated in programs other than TSS?
	V24	Gender
	V27	college courses related to EE?
	V28	Member of organizations?
	SUBJECT2	Teach all subjects?
	TEACH2	Teaching experience

Estimation terminated at iteration number 3 because
Log Likelihood decreased by less than .01 percent.

-2 Log Likelihood	49.441
Goodness of Fit	37.634
Cox & Snell - R^2	.079
Nagelkerke - R^2	.106

	Chi-Square	df	Significance
Model	3.133	8	.9257
Block	3.133	8	.9257
Step	3.133	8	.9257

Classification Table for OUTSIDE
The Cut Value is .50
Selected cases RE EQ 1

		Predicted: Less than once a (L)	Predicted: Once a month or (O)	Percent Correct
Observed				
Less than once a	L	12	8	60.00%
Once a month or	O	7	11	61.11%
			Overall	60.53%

Classification Table for OUTSIDE
The Cut Value is .50
Unselected cases RE NE 1

		Predicted: Less than once a (L)	Predicted: Once a month or (O)	Percent Correct
Observed				
Less than once a	L	23	24	48.94%
Once a month or	O	10	22	68.75%
			Overall	56.96%

* Some of the unselected cases are not classified due to missing values for the independent variables or categorical variables with values out of the range of the selected cases.

---------- Variables in the Equation ----------

Variable	B	S.E.	Wald	df	Sig	R	Exp(B)
OTHERTSS	.5931	.7578	.6126	1	.4338	.0000	1.8096
V20	-.1496	.9135	.0268	1	.8699	.0000	.8610
V24	-.3405	.8837	.1485	1	.7000	.0000	.7114
V27	.5125	.7802	.4315	1	.5112	.0000	1.6695
V28	.3593	1.0477	.1176	1	.7316	.0000	1.4324
SUBJECT2	.5134	.8097	.4020	1	.5261	.0000	1.6710
TEACH2			.4259	2	.8082	.0000	
TEACH2(1)	-.7098	1.0957	.4197	1	.5171	.0000	.4917
TEACH2(2)	-.3311	.8431	.1542	1	.6946	.0000	.7182
Constant	-.9118	1.2166	.5617	1	.4536		

Correlation Matrix:

	Constant	OTHERTSS	V20	V24	V27	V28	SUBJECT2	TEACH2(1)	TEACH2(2)
Constant	1.00000	-.18813	-.56510	-.61564	-.33487	-.06129	-.59020	-.02444	.07754
OTHERTSS	-.18813	1.00000	-.07899	.11930	-.18191	-.31757	-.02680	.33534	.08673
V20	-.56510	-.07899	1.00000	.52999	-.17446	-.12706	.35482	.20491	.03020
V24	-.61564	.11930	.52999	1.00000	-.06610	-.32937	.16341	.14941	.01923
V27	-.33487	-.18191	-.17446	-.06610	1.00000	.29759	-.04761	-.23780	-.08719
V28	-.06129	-.31757	-.12706	-.32937	.29759	1.00000	.01350	-.49757	-.10860
SUBJECT2	-.59020	-.02680	.35482	.16341	-.04761	.01350	1.00000	.01656	-.22959
TEACH2(1)	-.02444	.33534	.20491	.14941	-.23780	-.49757	.01656	1.00000	.50040
TEACH2(2)	.07754	.08673	.03020	.01923	-.08719	-.10860	-.22959	.50040	1.00000